STATE OF CALIFORNIA
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DEPARTMENT OF NATURAL RESOURCES
DEWITT NELSON, Director

DIVISION OF MINES
FERRY BUILDING, SAN FRANCISCO 11
OLAF P. JENKINS, Chief

San Francisco BULLETIN 173 December 1956

MINERALS OF CALIFORNIA

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and

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LETTER OF TRANSMITTAL

To His Excellency
The Honorable Goodwin J. Knight
Governor of the State of California

Dear Sir: I have the honor to transmit herewith Bulletin 173, *Minerals of California*, prepared under the direction of Olaf P. Jenkins, Chief of the Division of Mines.

Minerals of California is one of the Division's most widely appreciated publications. Essentially a catalog of mineral species, the book is a basic reference for all persons interested in minerals. Bulletin 173 is the eighth and longest of the Division's series of lists of California minerals—a series inaugurated in 1884 with 135 mineral species. The current edition consists of 523 species.

Bulletin 173 has been prepared by Dr. Joseph Murdoch of the University of California, Los Angeles, and Dr. Robert W. Webb of the University of California, Santa Barbara College, as part of a continuing cooperative project between the Division of Mines and the State University.

Respectfully submitted,

DeWitt Nelson, Director
Department of Natural Resources
October 26, 1956

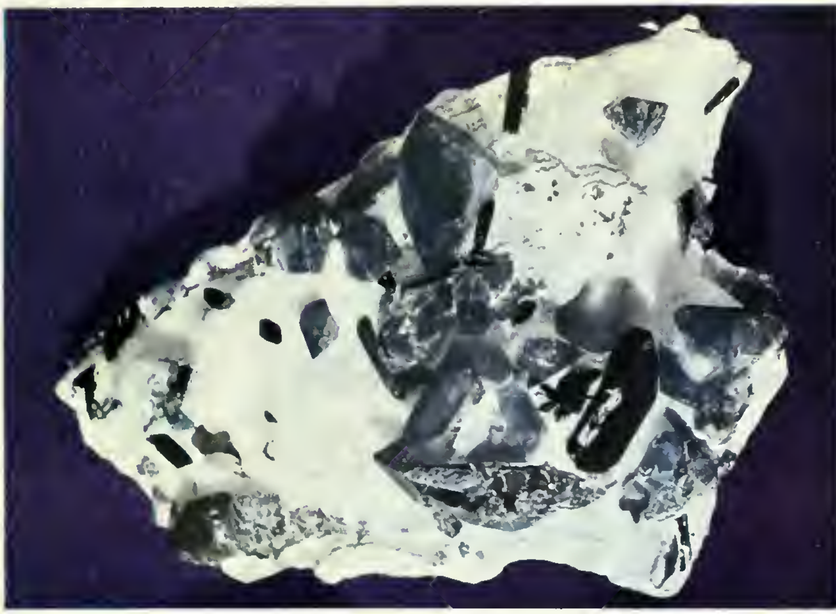

FIGURE 1A. BENITOITE. Crystals with neptunite in natrolite. *Courtesy Julius Gisler; photo by Gabriel Moulin Studio.*

FIGURE 1B. NEPTUNITE. Crystals with benitoite and joaquinite in natrolite. *Courtesy Julius Gisler; photo by Gabriel Moulin Studio.*

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PREFACE

Widespread interest in California minerals and mineral resources began early in the history of the state, and has continued to increase to the present time. It has received a great impetus by the organization of many mineral societies, which have multiplied in number, and now have large memberships in California. The increasing number of minerals and mineral occurrences which are still being reported reflects this growing interest, and is shown in the swelling size of successive catalogs of California minerals.

The first catalog was W. P. Blake's, which was published in 1866, and listed 77 mineral species in a small pamphlet of 31 pages. It was followed in 1884 by a list compiled by H. G. Hanks, then State Mineralogist, carrying 135 species. In 1914, A. S. Eakle compiled a comprehensive list of minerals found in California, including 352 species, which was published as Bulletin 67 of the State Mining Bureau. A revision by the same author in 1923 increased the number of known species to 417 (Bulletin 91), and a revision by Professor Adolf Pabst, University of California, Berkeley, issued in 1938, increased the number of known species to 446 (Bulletin 113).

In 1948, Professors Joseph Murdoch and Robert W. Webb published a completely reorganized catalog (Bulletin 136) in which it was endeavored to provide written, or at least authoritative verbal confirmation, of all mineral occurrences already listed, of all new entries representing old occurrences not previously mentioned, and of occurrences discovered since 1938, up to and including 1945. This was not possible in all cases, because many earlier references are apparently nowhere documented, and represent verbal information from some unrecorded source, personal observation, or hearsay. This is particularly the case with entries in Eakle's Bulletins 67 and 91; he added many items undoubtedly from his own extensive investigations throughout the state, and often did not indicate which ones these were. Bulletin 136 included some 70 additional species, and increased the total for the state to 516 definite minerals, besides many sub-species or varieties. The present bulletin increases the total to 523, even with the discrediting of several earlier-noted minerals.

In the preparation of the 1948 Bulletin 136, the writers scanned personally all the literature dealing in any way with California minerals, and many publications of a non-geologic nature which were suspected of carrying mineralogic information. In this search, nearly 160 serials were consulted, in most cases from their earliest numbers. Besides these, many individual publications were studied. From these sources, references to thousands of individual occurrences were accumulated and compiled.

In Bulletin 136 the introductory portion was considerably enlarged to include historical and geologic sketches of famous mineral localities. These localities—the Mother Lode, Crestmore, Searles Lake, Pala and Mesa Grande, and others—have contributed many minerals found for the first time in California. A list of these minerals, with the dates of their first published descriptions, follows:

Partzite, 1867
Melonite, 1867
Mariposite, 1868
Calaverite, 1868
Metacinnabar, 1870
Aragotite, 1873
† Trautwinite, 1873
Stibioferrite, 1873
Roscoelite, 1875
Posepnyte, 1877
† Sonomaite, 1877
Ionite, 1878
Tincalconite, 1878
Colemanite, 1883
Hanksite, 1884
Napalite, 1888
Sulphohalite, 1888
Knoxvillite, 1890
Redingtonite, 1890
Iddingsite, 1893
Lawsonite, 1895
Northupite, 1895
Pirssonite, 1896
† Palacheite, 1903
Bakerite, 1903
Boothite, 1903
Tychite, 1905
Benitoite, 1907
Arcanite, 1908
Joaquinite, 1909
† Neocolemanite, 1911
Palaite, 1912
Salmonsite, 1912
Sicklerite, 1912
Stewartite, 1912
Inyoite, 1914
Meyerhofferite, 1914
Searlesite, 1914
Wilkeite, 1914
† Crestmoreite, 1917
† Eakleite, 1917
Griffithite, 1917
† Riversideite, 1917
Plazolite, 1920
Vonsenite, 1920
† Jurupaite, 1921
Merwinite, 1921
Kempite, 1924
Foshagite, 1925
Kernite, 1927
Chromrutile, 1928
Probertite, 1929
Curtisite, 1930
Krausite, 1931
Sanbornite, 1931
Schairerite, 1931
Tilleyite, 1933
Burkeite, 1935
Woodhouseite, 1937
Ellestadite, 1937
Teepleite, 1938
Veatchite, 1938
† Nuevite, 1946
Sahamalite, 1954

In this bulletin, minerals are arranged in alphabetical order, so that only the name of the mineral need be known to find it immediately. A very complete system of cross-referencing has been employed, so that varietal names (such as chrysotile) are referred to the main entry (as serpentine). It is recognized that this arrangement separates minerals which belong to common groups, but the convenience of the alphabetical scheme is thought to outweigh this scattering of groups. For the benefit of those who wish a survey of related minerals, a table of California minerals, a classification modified from the most recent Dana classification, has been compiled, and is also presented herein.

Occurrences are listed by counties for each mineral; and when of particular importance or interest, are accompanied by a brief description of their geologic setting. For each occurrence, whenever possible, one or more references to the literature are given, so that the user may turn to the original description, which is ordinarily more detailed than can be given here. A number of occurrences [marked (N. R.)] still lack written, or even adequate verbal documentation, and the writers will be glad to have drawn to their attention any reference to or confirmation of such cases. Occurrences verified by personal communication are marked (p.c.); those represented by specimens in the exhibit of the Division of Mines at San Francisco carry the letters S.M.B., and the specimen number, as S.M.B. (5158).

Species first discovered in California are marked by an asterisk (*), and followed by the date of the first published description. Discredited species are marked by a dagger (†).

Under each mineral, preceding the list of occurrences, is given a brief description, to assist in its identification without the use of elaborate equipment. This description includes the chemical composition, crystal form and habit if distinctive, cleavage, hardness (H.), specific gravity (G.), sometimes luster, and occasionally chemical or blowpipe tests which may readily be made. The technical details of description, omitted here for the sake of simplicity, may be found in any standard textbook on mineralogy.

† Discredited species.

The bibliography, containing some 2,000 titles, does not attempt to cover all notices of California minerals, but it is by far the most comprehensive yet assembled on California mineral occurrences. It lists all important publications in the field, and practically all those of lesser importance.

Occurrences noted since January 1, 1955 are being currently accumulated and filed, for future supplements of the Bulletin, and information on new or omitted occurrences, and corrections, are solicited. Such information may be sent to either of the authors or to the Division of Mines in San Francisco.

It would be impracticable to acknowledge the services of all who have cooperated in the preparation of this volume, but the writers wish to express their thanks to the following, who have made important contributions to the work: Professor Adolf Pabst, University of California, Berkeley; Professor A. O. Woodford, Pomona College; the late Professor Charles Palache, Harvard University; Dr. W. T. Schaller, U. S. Geological Survey; Dr. W. F. Foshag, U. S. National Museum; the late Mr. M. Vonsen, Petaluma, California; the member Societies of the California Federation of Mineralogical Societies; Professor George Tunsell, University of California, Los Angeles; Professor C. Douglas Woodhouse, University of California, Santa Barbara; and many individuals who generously wrote comments and criticisms. Of special help was Dr. Olaf P. Jenkins, Chief of the Division of Mines of California, and his entire staff of co-workers.

Financial support for the project was received from the State Department of Natural Resources, through the Division of Mines. Acknowledgment should also be made of subsidies received during the period 1936 to 1942 for the study of mineral localities in California, from the Committee on Research, University of California, Los Angeles. The results of these studies, although published elsewhere, have contributed to the accuracy and completeness of this volume.

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June 15, 1955

INTRODUCTION

A mineral may be defined as a chemical compound formed under natural conditions, having essentially uniform properties and composition. Most minerals are solids at ordinary temperatures, mercury and water being exceptions, occurring normally as liquids. In the solid form, minerals ordinarily possess a definite atomic structure, characteristic for each species, although this structure is occasionally missing, in which case the mineral is termed *amorphous.* Under favorable conditions of formation, they assume definite external forms, called *crystals,* but if their growth is interfered with, the resulting mass is called *crystalline,* or *massive.*

Minerals may be formed by crystallization from a *melt,* as in the case of those characteristic of igneous rocks, from *solution,* as in veins, or by *sublimation* from a vapor, usually at a volcanic vent.

Igneous rocks are those which have been formed by the solidification on cooling, of magma, or molten rock material. Usually this results in the crystallization of the rock-forming minerals, but sometimes the cooling is so rapid as to prevent this crystallization, and the resulting product is like a glass, and is called obsidian. At times igneous rocks cooling on the surface of the earth have bubble-holes, formed by escaping gases. These openings are called vesicles, and may be filled, or partially filled, by deposition of later mineral matter to form *geodes* or *lithophysae.* The texture of igneous rocks is determined largely by the rate of cooling, and may be granitoid (coarse), for slowly cooled, or felsitic (fine) for rapidly cooled, masses. The minerals present represent the general relative abundance of elements in the melt, and differ quite widely in their nature. *Granite* (and the surface form, *rhyolite*) has essentially quartz and orthoclase feldspar, with usually considerable plagioclase, and often hornblende or augite, muscovite or biotite, and minor amounts of apatite, magnetite, zircon, etc. *Syenite* (and *trachyte*) are much the same, but quartz is usually absent. *Diorite* (and *andesite*) carry plagioclase and hornblende, with occasional pyroxene or biotite, and sometimes quartz *(granodiorite). Gabbro* (and *basalt*) are essentially plagioclase and augite (or one of the other pyroxenes), or olivine. *Peridotite* (not usually represented by a surface form) may be essentially a single mineral, such as olivine, pyroxene, or hornblende, and often carries ilmenite or chromite in considerable amount.

Sedimentary rocks are usually secondary in their origin, formed from the products of disintegration and decay of earlier rocks. Sometimes they are formed by chemical precipitation of dissolved material, as in the case of rock salt or gypsum. More commonly they are made by the accumulation of actual particles of rock material washed down from the land surface and spread out on the sea (or lake) bottom. The fine-grained sediments (*shale*), are largely clay and finely divided quartz. The coarse are sand grains (*sandstone*), or pebbles (*conglomerate*). *Limestones* are formed ordinarily by the accumulation of calcium carbonate in the shells or skeletons of marine organisms (mollusces, corals, etc.). They are usually more or less re-crystallized, so that much of the evidence of organic origin is destroyed. Limestones may be enriched in magnesia to form *dolomite.*

Metamorphic rocks are formed by the action of powerful earth forces on any earlier-formed rock mass, so that notable changes in character are produced. These changes involve the development of *foliation* (a roughly parallel arrangement of the mineral grains), recrystallization, or the formation of new minerals by a re-combination of elements already present, or added due to the action of igneous intrusions. Many new compounds are formed in this way, especially by the action of igneous rocks (contact metamorphism), and the great variety of minerals at Crestmore has been largely produced in this way.

Pegmatites are igneous rocks, which sometimes partake of the character of veins, and are often noted for the great variety of unusual mineral species present. They are formed by the separation from a partly crystallized magma, of a residue which is enriched in silica and often in rare elements. This crystallizes in vein- or dike-like form, often with very coarse, even giant, texture. Where rare elements are present, they may abound in cavities, or *vugs,* in which unusual compounds may crystallize in well-developed forms. The gem-pegmatites of southern California show well this type of occurrence.

Veins are formed by deposition of minerals from solutions standing in, or traversing, fractures in any rock. They are formed at all temperatures from just below that of magmas to those of the surface waters, and constitute an important source of the less common, as well as of the more usual minerals. If the crevices are not completely filled, the resulting cavities may be lined with beautifully formed crystals. Veins may be formed by waters travelling upward from an igneous source, or by solutions soaking down from the surface. They may be formed by filling of open spaces, or by replacement of minerals already present along the walls of cracks. A very great number of mineral species are found in veins.

Pseudomorphs. When replacement of one mineral by another has proceeded so gently that the form of the original mineral is preserved, a *pseudomorph* results. The mineral pyrite is frequently replaced by limonite, to produce rather perfect pseudomorphs, and many other instances of this phenomenon might be mentioned.

HISTORICAL AND GEOLOGICAL SKETCHES

ABORIGINAL AND INDIAN MINERALS

A number of minerals were known and used for one purpose or another by pre-historic races, and by the later Indians of California. Many references to these are to be found in the following authorities: Heizer and Treganza (1) who give an extensive bibliography, with a quite extensive list of minerals and occurrences; Abbott, Haldeman, Wells, Schumacher, Woodward, Yates, Kunz (24), Walker, and others have also supplied information on this subject.

The earliest known mineral was apparently turquoise, which was mined by aboriginal tribes in the northeast corner of San Bernardino County in pre-historic times. The old workings here were rediscovered in 1897 by T. C. Bassett, who found in them a couple of stone hammers, and called his claim the Stone Hammer mine. This find aroused so much interest that the *San Francisco Call,* in 1898 sent out an expedition conducted by Dr. Gustav Eisen of the California Academy of Sciences to explore the mines. His account was published in an extensive article in the *Call* of March 18, 1898, and led to considerable investigation of the area. The following extracts from Kunz, (24) pp. 107-109, give a good description of the find and of the general character of the area, which is in the Turquoise Mountains, T. 16 N., R. 10 and 11 E., S. B.:

"Mr. T. C. Bassett had observed in this neighborhood a small hillock where the float rock was seamed and stained with blue. On digging down a few feet, he found a vein of turquoise—a white talcose material inclosing nodules and small masses of the mineral, which at a depth of 20 feet showed fine gem color. Two aboriginal stone hammers were met with, as usual at all the turquoise localities in the southwest, and from this circumstance the location was named the Stone Hammer mine.

"The State Mining Bureau reported at about the same time that turquoise had been found in the desert region between Death Valley and Goff's Mining District, nearer the former, and that good samples were in the museum of the Bureau. * * *

"The turquoise district, as described by Mr. Eisen and others of the party, occupies an area of 30 or 40 miles in extent, but the best mines are in a smaller section, about 15 miles long by 3 or 4 in width. The region is conspicuously volcanic in aspect, being largely covered with outflows of trap or basaltic rock reaching outward from a central group of extinct craters. These flows extend for many miles in all directions, and appear as long, low ridges, separated by valleys and cañons of the wildest character. Among these basaltic rocks and in the valleys are found smaller areas of low, rounded hills of decomposed sandstones and porphyries, traversed at times by ledges of harder crystalline rocks, quartzites, and schists. In the cañons and on the sides of these hills are the old turquoise mines, appearing as saucer-like pits, from 15 to 30 feet across and of half that depth, but generally much filled up with debris. They are scattered about everywhere. Around them the ground consists of disintegrated quartz rock, like sand or gravel, full of fragments and little nodules of turquoise. Whenever the quartzite ledges outcrop distinctly they show the blue veins of turquoise, sometimes in narrow seams, sometimes in nodules or in pockets. The mode of occurrence appears closely to resemble that at Turquoise Mountain, Arizona. * * * Stone tools are abundant in the old workings, and the indications are plain that this locality was exploited on a great scale and probably for a long period, and must have been an important source of the turquoise used among the ancient Mexicans. From an archaeological point of view this locality possesses remarkable interest. The cañon walls are full of caverns, now filled up to a depth of several feet with apparently wind-blown sand and dust, but whose blackened roofs and rudely sculptured walls indicate that they were occupied for a long time by the people who worked the mines. In the blown sand were found stone implements and pottery fragments of rude type, incised but not painted. The openings to these caves are partially closed by roughly built walls composed of trap blocks piled upon one another with no attempt at fitting and no cement, but evidently made as a mere rude protection against weather and wild beasts. The tools, found partly in the caves and largely in

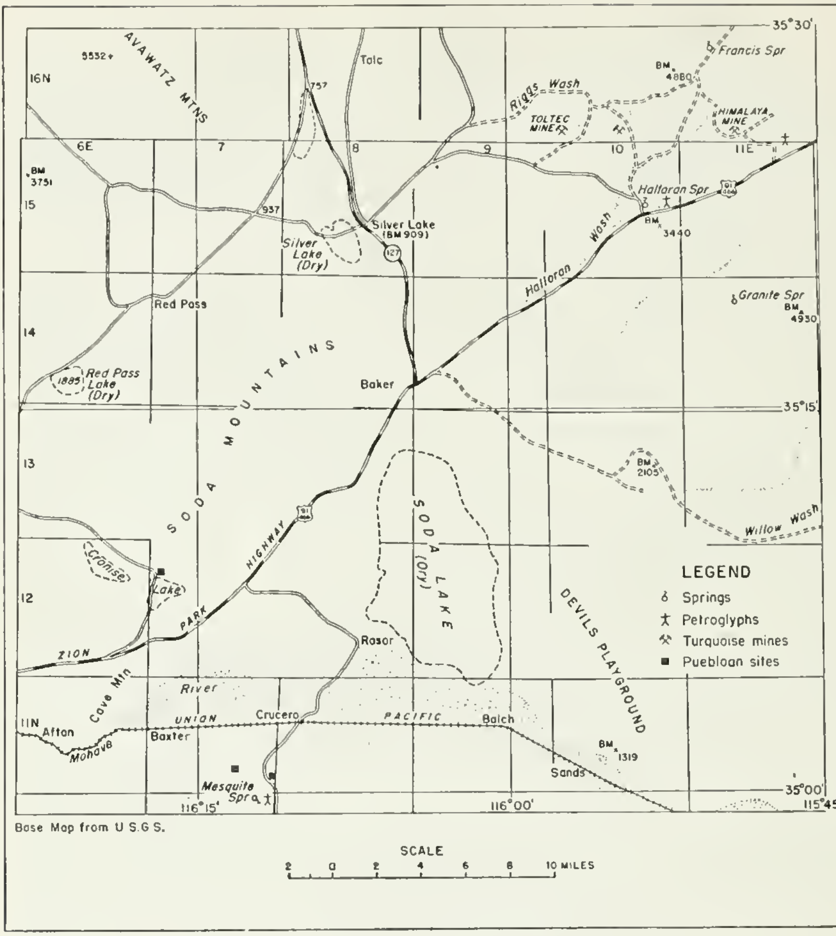

FIGURE 2. Map of the Mojave Sink region, San Bernardino County, California, showing location of turquoise mines. *After M. J. Rogers (1).*

the mine pits are carefully wrought and polished from hard basalt or trap, chiefly hammers and adzes or axes, generally grooved for a handle and often of large size. Some are beautifully perfect, others much worn and battered by use.

"The most impressive feature, however, is the abundance of rock carvings in the whole region. These are very varied, conspicuous, and peculiar, while elsewhere they are very rare. Some are recognizable as 'Aztec water signs,' pointing the way to springs; but most of them are unlike any others known, and furnish a most interesting problem to American archaeologists. They are numbered by many thousands, carved in the hard basalt of the cliffs, or, more frequently, on large blocks of the same rock that have fallen and lie on the sides of the valleys. Some are combinations of lines, dots, and curves into various devices; others represent animals and men; a third and very peculiar type is that of the 'shield figures,' in which complex patterns of lines, circles, cross hatchings, etc., are inscribed within a shield-like outline perhaps 3 or 4 feet high.

"One curious legend still exists among the neighboring Indians that is in no way improbable or inconsistent with the facts. The story was told Mr. Eisen by 'Indian Johnny,' son of the Piute chief, Tecopah, who died recently at a great age, and who in turn had received it from his father. Thousands of years ago, says the tale, this region was the home of the Desert Mojaves. Among them suddenly appeared, from

the west or south, a strange tribe searching for precious stones among the rocks, who made friends with the Mojaves, learned about these mines, and worked them and got great quantities of stones. These people were unlike any other Indians, with lighter complexions and hair, very peaceable and industrious, and possessed of many curious arts. They made these rock carvings and taught the Mojaves the same things. This alarmed and excited the Piutes, who distrusted such strange novelties, and thought them some form of insanity or 'bad medicine,' and resolved on a war of extermination. After a long desperate conflict, most of the strangers and Mojaves were slain, since which time, perhaps a thousand years ago, the mines have been abandoned."

Other minerals were known to the Piute and other Indian tribes of more recent times. Cinnabar, hematite, and manganese oxides were used as color pigments, and talc in some cases as white. Talc in the form of steatite was formed into cooking vessels, beads or other ornaments, arrow straighteners, pipes, or finger rings. Fluorite was occasionally made into beads. Quartz crystals were collected, perhaps for their appearance, or as part of the medicine man's equipment. Mica plates served occasionally as ornaments. Magnesite was made into tokens with value for exchange.

Of these, talc, or steatite, was most commonly known. Practically all the old Indian sites have yielded steatite receptacles. It was mined in a number of localities, of which the most important was on Santa Catalina Island. Steatite bowls or vessels partly carved out of the bed rock, and attached by a stem, which was later to be broken off and smoothed away, have been described as still remaining in the quarries at this place. Other localities for steatite are listed by Heizer and Treganza, (1) p. 307, as follows: Klamath River, two localities; 1 mile east of Tuolumne; 4 miles east of Lindsay, Tulare County; near mouth of Carrizo Gorge, San Diego County; west side of Williams Valley, Mendocino County; Santa Ynez Mountains; Santiago Canyon near Mount Pinos, Ventura County; Table Mountain, Madera County; Fish Creek Mountain, Fresno County; northeast of Cloverdale, Sonoma County; near Burnt Ranch, north fork of Trinity River, Trinity County.

Cinnabar was mined in at least two places in the state. One, the most important, was the famous New Almaden mine, near San Jose, and the other, Last Chance Peak, north of Death Valley. The New Almaden locality was known in very early times, and Indians came to it from as far away as Oregon and Washington. An interesting account of the locality is given by Downer, (1) p. 221.

"We are still three hundred and thirty-three feet below the summit, where in 1845 a shaft was sunk, and mining first commenced. This point had been the resort of the aborigines not only of this State, but from as far as the Columbia River, to attain the paint (vermillion) found in the cinnabar, and which they used in the decoration of their persons. How long this had been known to them cannot be ascertained; probably a long time, as they had worked into the mountain some fifty or sixty feet, with what implements can only be conjectured. A quantity of round stones, evidently from the brook, was found in a passage, with a number of skeletons; the destruction of life having been caused, undoubtedly, by the sudden caving of the earth burying the unskilled savages in the midst of their labors."

Quartz crystals appear in large numbers in Indian sites, and were perhaps collected for their magical properties. One arrowhead, chipped out of a clear quartz crystal, is in the museum of the State Mining Bureau (S.M.B. 11562), but in general, the crystals were untouched, or occasionally pasted on one end with asphaltum, apparently so that they could be slung by a cord.

Mica plates, several inches across, and perforated, have been found, apparently used as ornaments.

Fluorite beads, from an unknown source, were found in some of the sites near Santa Barbara, San Luis Obispo, and along the north shore of Buena Vista Lake.

Magnesite from near Sulphur Bank, in Lake County, was shaped into cylindrical forms, and baked, to produce reddish, creamy, or black coloration, then polished, perforated, and used as money.

THE DISCOVERY OF GOLD IN CALIFORNIA

The history of gold in California far antedates James Marshall's famous discovery in 1848, although the early accounts are often vague or uncertain. In Hakluyt's Voyages, Drake in 1579 is said to mention the probability of gold here: "There is no part of the earth here to be taken up wherein there is not some special likelihood of gold or silver." Since he did not go inland, it is a trifle difficult to see how he could have had more than wishful thinking as a basis for his comment. This may well have been the source of the statement in 1816 by Jameson (1) p. 13: "On the coast of California there is a plain of 14 leagues in extent, covered with an alluvial deposite, in which lumps of gold are dispersed."

After Drake, there were many Spanish expeditions based on Mexico, but the journals of these make little or no mention of gold. A most entertaining story is told by Captain George Shelvocke, (1) p. 401, a British privateer, in his account of "A Voyage around the World by way of the Great South Sea, perform'd in the years 1719, '20, '21, '22 in the Speedwell of London" published in 1726. This does not concern our own state, but lower California, just north of Cape San Lucas. It is, however, of sufficient interest to quote briefly:

"The soil about *Puerto Seguro* (and very likely in most of the vallies) is a rich black mould, which, as you turn it fresh up to the sun, appears as if intermingled with golddust, some of which we endeavor'd to wash and purify from the dirt; but tho we were a little prejudiced against the thoughts that it could be possible that this metal should be so promiscuously and universally mingled with the common earth, yet we endeavour'd to cleanse and wash the earth from some of it, and the more we did, the more it appeared like gold, but in order to be farther satisfied, I brought away some of it, which we lost in our confusions in China."

Presumably his "gold" flakes were flakes of mica; but such an account might easily have formed the foundation for later, supposedly authentic tales.

The next account is more trustworthy, reporting placers worked in the "Carga Muchacha" district near Yuma, in 1775, Hanks (12) p. 217, and at St. Isidore [San Isidro] near San Diego in 1825, Wyld (2) p. 37, or in 1828, W. W. Jenkins (1) p. 70. Gold was reported from California in 1818 by Teschemacher (3) p. 287. Wyld (2) p. 37 also records a "small thread of gold worked in the Saint Barbara district in 1840." The San Francisco *Alta Californian* about 1868 (?) carried a letter from Abel Stearns relating the discovery of gold at San Francisquito in 1842, by Francisco Lopez, some of which gold he sent to the United States Mint in 1843. Duflot de Mofras (1) p. 186, an emissary of the French government, notes the discovery of a " * * * gold vein at San Francisquito, 6 leagues beyond San Fernando, in 1842, with pieces up to 2 or 3 ounces in weight." These two are apparently the same, and presumably refer to Placerita Canyon. Rickard (3) pp. 14, 15, quotes

the report of Manuel Casteñares to the King of Spain in 1844 on the same locality: "Gold placers discovered in the course of the last year have attracted the greatest attention, for they extend nearly 30 leagues." These were near San Fernando Mission [Placerita Canyon again] discovered by Francisco Lopez, March 9, 1842, and worked by him in company with Charles Baree.

Rather surprisingly these reports either did not reach the east coast of America, or made very little impression on the public there, as it was not until after Marshall's discovery at Coloma in 1848, that the gold-rush excitement broke.

The accounts of the discovery of gold at Coloma by James Marshall, are, as is usually the case, conflicting in detail, even those purporting to be eye-witness reports. They are all in general agreement that the discovery was made by Marshall in the mill-race at Coloma in January or February 1848. W. W. Jenkins (1) p. 72 gives the date as January 19 without quoting any specific authority. J. Ross Browne and James W. Taylor (1) p. 14, state that on January 19, 1848, Marshall found some gold in the mill-race at Coloma. The first printed notice occurred on March 15, in the newspaper printed in San Francisco. Hittel (4) p. 529 quotes the diary of Henry W. Bigler, one of Marshall's fellow workers, which gives the date as January 24. He prints a facsimile reproduction of Bigler's diary. Marshall took the gold to Sutter's 4 days after the discovery, and they tested it.

George M. Evans (1) p. 385 notes the recovery of specks of gold from the bank of the San Joaquin river near Stockton, in September 1846, and reports the news of *abundant* gold near San Diego and the river Gila in August, 1847. He then goes on to make the following statement:

"On the 9th of February 1848, I with Henderson Cox, Beardsley Beers, two Shepards, and a number more were in the lower end of the mill-race [at Coloma] when Marshall, the overseer, and his little girl came in, and the child picked up a pretty stone as she called it, and showed it to her father, who pronounced it gold. He was so excited about it that he saddled his horse and that day rode to Sutter's Fort to tell Captain Sutter—but he did not believe it worth notice, and for a while the idea died away."

Evans also mentions a very early reference to gold supposedly made by one Lyola Cavello (or Cabello), a priest at "San José Mission on the bay of San Francisco," in *Recordado en Historia el California Alta* printed in Spain in 1690. This mentions small quantities of gold in "placeros" of streams to the north. There are various reasons for doubting the validity of this quotation. There were no missions in California as early at 1690; the title of the publication is not as it should be in Spanish; "Lyola" is not a given name, and should probably be "Loyola" in any case; and California was not known as Alta California until much later. There is probably some basis of truth behind this quotation, but in its present form it is quite valueless. It has been mentioned here as a matter of interest and to illustrate the general vagueness and unreliability of early reports.

In those days of slow travel, the news of Marshall's discovery was a long time reaching the east, and it was not until late in 1848 and early in 1849, that letters began coming in. One of the earliest records was a letter written by T. L. Hasse, September 26, 1848, from New York to a correspondent in Germany announcing the discovery, Berg-u.

Hutt. Zt. (1) p. 791. The first official record was a report to the War Department by Mason, (1) p. 528. After this time there was a flood of letters and reports about California gold. One early report, R. M. Patterson (1) p. 61, tells of the finding of a 15-pound nugget, perhaps the same as that picked up by a soldier of Stevenson's regiment on the Mokelumne River in 1848, and is of interest as recording for the first time the presence of platinum in the gold sands.

A most unusual and spectacular story is told of an occurrence of gold in California, along the beach at Gold Bluff, Humboldt County, by S. Johnson (1), pp. 534-537. According to this account, a party of men travelling south from Oregon, in the year 1850, was forced by thick timber to turn out towards the shore. Reaching it, to their amazement, the beach appeared to be literally paved with gold. They could not believe their eyes, but on closer examination, found that the waves had accomplished a perfect job of panning, and had spread the gold particles almost uniformly over the surface of the sands. They scraped off some handfuls from the surface, but as they were short of provisions, and travel-weary, pushed on to their destination. The samples proved to be nearly half gold, and an expedition was immediately organized to exploit the beach. Unfortunately, but as was to be expected, by the time the party reached the beach once more, the waves and tide had completely dispersed the gold, so that the sands were no longer concentrates, and of no particular value.

BORAX

Discovery in California

The discovery of borax in California is interestingly described by Dr. John A. Veatch, in a letter to the Borax Company of California, dated June 28, 1857, and quoted in J. R. Browne and Taylor (1) pp. 179-185. The following quotations have been taken from this letter:

"I believe I was the first to detect the borates in mineral waters in this State, and perhaps, as yet, the only observer of their localities. My attention was first drawn to this subject by noticing crystals of bi-borate of soda in the artificially concentrated water of a mineral spring which I chanced at the time to be examining for other matters. This water was from one of the several springs since known as the Tuscan springs, and which have gained some fame, and very justly, I believe, as medicinal waters. The spot has been described by Dr. Trask under the name of the Lick Springs, and is so designated on Britton and Rey's late map; lying on the north part of Tehama county, eight miles east of Red Bluff. The crystals alluded to were observed on the eighth day of January, 1856. Several pounds were subsequently extracted by evaporating the water to a certain degree of concentration and allowing the borax to crystallize. The pioneer specimens of this product were deposited in the museum of the California Academy of Natural Sciences, as an evidence of the existence of a new and important link in the chain of our mineralogical productions, showing that along with the rich productions of the noble and useful metals, we have also the mineral substance so essential to their easy application to the purposes of man. * * *

"My mind being now alive to the subject, I learned, upon inquiry, of other localities which I supposed might yield the borates. One of these, near the mouth of Pitt river, forty miles north of the Tuscan springs, I had the pleasure of visiting in company with Dr. Wm. O. Ayres, in April, 1856. Specimens there obtained yielded the borate salts; and, from a subsequent examination of the intermediate country, several similar localities were found. The quantity was too small to be of any practical importance, but the prevalence of the salt gave encouragement to further search. A reconnoissance of the 'coast range' of mountains, from the neighborhood of Shasta over a length of some thirty miles towards the south, brought to light borates in the numerous small springs abounding in that region, but only in minute quantities. These springs were found almost exclusively in the sandstone, or in the

magnesian limestone overlaying it; and the borates seemed to abound in localities bearing indications of volcanic disturbance. Thus a kind of guide was obtained in the prosecution of further explorations. I began to entertain hopes of finding streams with stronger impregnations, or accumulations, of the borates in salt lagoons said to exist in Colusi county, where the sandstone formation was largely developed, the adjacent foot-hills presenting volcanic features. Hunters told tales of mineral springs of sulphurous and bitter waters; of lakes of soda, and alkaline plains, white with efflorescent matters, in that region. Not being in a situation immediately to visit those inviting localities, I had, for the time, to content myself with pointing out to the hunters and others occasionally passing through that country such appearances as I wished particularly to be noted. Their reports, together with specimens sometimes furnished, were all corroborative of the correctness of my theory. Colonel Joel Lewis, of Sacramento City, who occasionally visited the coast range on hunting excursions, and to whom I explained the object of my search, and who, although not a scientific man, is an intelligent observer, had the kindness to look, in his peregrinations, for certain indications. He subsequently informed me by letter that he had met with an Irishman, living in Bear valley, who had found a 'lake of borax,' as it was pronounced by an Englishman who lived with the Irishman, and who had been at one time employed in a borax manufactory in England, and therefore assumed to speak knowingly on the subject. He also informed me in the same letter that a Major Vanbibber, of Antelope valley, had discovered large quantities of nitre in the same neighborhood. These glowing reports led me to hasten the excursion I had so long contemplated. In a personal interview with the colonel he told me of an enormous mass, of a white, pulverulent substance, he had himself observed near the margin of Clear lake, of the nature of which he was ignorant. Mr. Charles Fairfax, who was with the colonel at the time, stated to me that a small rivulet running at the base of the white hillock was an intensely impregnated mineral water, totally undrinkable, as he had accidently discovered by attempting to slake his thirst with it. From the meagre information gathered from these gentlemen, I was led to hope the 'hill of white powder,' as they termed it, might prove to be borate of lime. I determined to satisfy myself by personal examination at once, and I finally induced Colonel Lewis to act as my guide by furnishing him with a horse and paying expenses. It was some time in the early part of September of last year that he and I left Sacramento for the localities that had so much excited my hopes. At the town of Colusi, which we reached by steamer, horses were obtained, and we proceeded in a westerly direction across the Sacramento valley to the foot-hills of the coast mountains, a distance of about twenty miles. That portion of the plains skirting the hills gave unmistakable evidence of a heavy charge of mineral salts, and the exceedingly contorted and interrupted state of the hill strata enabled me at once to predict the presence of the beloved borates, which chemical trial on some efflorescent matter taken from a ravine proved to be the case in a slight degree. At this point we entered 'Fresh-water cañon,' which cuts the hills and forms a passway into Antelope and Bear valleys. Here I received information from a settler of a hot sulphur spring a few miles south of Bear valley, on one of the trails leading to Clear lake. This spring we succeeded in finding on the following day. It was with no small pleasure that I observed the outcropping magnesian limestone in the hills surrounding the valley of the springs. The strong smell of sulphurated hydrogen, and the appearance of a whitish efflorescence on the rocks, manifested, even at a distance, almost the certainty of finding the mineral I sought. The indications were not deceptive. The efflorescence proved to be boracic acid, in part, while the hot, sulphurous water held borate of soda in solution, together with chlorides and sulphates. There are three hot springs at this place, and several cold ones, all alike strongly impregnated with common salt and borax. * * * The same phenomenon occurs here that is observed at the Tuscan springs, viz., free boracic acid in the efflorescence on the margin of the springs, while the water itself shows a decided alkaline reaction. * * *

"The following day we reached the 'Hill of White Powder,' the goal of our hopes, on the margin of Clear lake. This 'White Powder Hill,' the goal of our hopes, proved an illustration of how little the recollections of mere casual observers are to be depended upon. The hill, in place of consisting of materials in a state of disintegration, so as to admit of being 'shoveled up,' as my friend supposed, proved to be a concrete volcanic mass, bleached white by sulphurous fumes, and looking, at a little distance, like a huge mass of slaked lime, which the inattentive observer might readily suppose to be a 'hill of white powder.' The hope of a treasure in the form of borate of lime vanished forever.

"The road had been rather toilsome, the weather exceedingly hot, and my guide not very well; and as he had gone the full length of the contemplated journey, and

felt somewhat disgusted at the result so far, and had nothing more to draw his attention in this direction, he proposed to return at once by the way of the Irishman's 'borax lake' and Vanbibber's nitre placer. This was agreed upon; so, collecting a few specimens of efflorescent matters from the ground, and filling a bottle with the water in the ravine, I closed the examination of the 'Hill of White Powder.' The ravine I afterwards called the 'boracic acid ravine,' and the white hill is now called 'Sulphur Bank.' Of these I shall have occasion to speak hereafter.

"Before leaving the neighborhood I determined, however, to know something more of its surroundings. I learned, upon inquiry of Mr. Hawkins, who lives near the spot, that a place not far off, known by the name of 'Alkali lake,' presented a rather peculiar appearance. Hawkins consented to act as my guide. After travelling a short distance, and clambering to the narrow edge of an almost precipitous mountain ridge, we looked down the opposite slope, equally steep, on a small muddy lake that sent up, even to our elevated position, no pleasant perfumes. Thus, on one of the hottest days September ever produced, without a breath of air to dilute the exquisite scent exhaled from two hundred acres of fragrant mud, of an untold depth, I slid down the mountain side into 'Alkali lake,' waded knee-deep into its soapy margin, and filled a bottle with the most diabolical watery compound this side the Dead Sea. Gathering a few specimens of the matter encrusting the shore, I hastened to escape from a spot very far from being attractive at the time, but which I have since learned to have no prejudice against. Of this place I shall have occasion to say more. * * *

"From Colusi my guide returned to Sacramento and I to Red Bluff; from there I came again to San Francisco, for the purpose of testing my specimens more critically than I was able to do in the country.

"Convinced of the richness of my 'Alkali lake' specimens, it remained to be seen whether the quantity was sufficient to justify the hope of making it available for practical purposes. A further and more strict examination was necessary. I felt, too, the propriety of a thorough exploration betwixt the Bluff and Clear lake, and more thence to the bay of San Francisco, thus rendering continuous the reconnoissance from Pitt river to the last-named point, a distance, in a direct line, of two hundred miles. After a hard struggle for the funds requisite, I returned to Red Bluff; and from thence, in company with my son, commenced a pretty thorough examination of the coast range and the adjoining edge of the Sacramento valley. * * *

"In due time I again reached the 'white hill.' The disgust of the first disappointment had worn off, and I felt disposed to re-examine the locality more critically. I now discovered, for the first time, that the 'white hill' was mostly a mass of sulphur, fused by volcanic heat. The external dust, composed of sulphur, mixed with sand and earthy impurities, and formed a concrete covering of a whitish appearance, hiding the nature of the mass beneath. On breaking the crust, numerous fissures and small cavities, lined with sulphur crystals of great beauty, were brought to light. Through the fissures, which seemed to communicate with the depth below, hot aqueous vapors and sulphurous fumes constantly escape. The fused mass, covering many acres and exhibiting a bluff front some forty feet high, is exceedingly compact and ponderous in structure; of various shades, from yellow to almost black. It seems to be very pure sulphur. The quantity is enormous, and at no distant day may be made available.

"From the 'sulphur bank' I again turned my attention to the ravine. The water, as I had before ascertained, was strongly impregnated with boracic acid, in a free state. The stream is small, yielding only about three gallons per minute, and is soon lost in the sandy soil, in its progress toward the margin of the lake. From the porous nature of the ground surrounding the spring, and saturated with the same kind of acid water, it is probable a large quantity escapes without making its appearance on the surface. The soil for some yards on either side of the ravine is, to the depth of an inch or two impregnated with boracic acid in summer. Sulphurretted hydrogen escapes in continued bubbles through the water, a feature common to all the borax localities I have yet found; in some places, however, the carburetted takes the place of the sulphuretted hydrogen. The head of this ravine is about three hundred yards from the margin of Clear lake, winding around the base of the 'sulphur bank,' receiving some small springs in its course, which seem to have their origin beneath the sulphur. The flat land bordering the lake, some eight acres in extent, through which the ravine runs, shows a strong impregnation of boracic acid in its soil. The point where the ravine enters the lake is marked by a large qnantity of water of a boiling temperature, issuing through the sand, a little within the margin of the lake. This percolation of hot water covers an area of one hundred and fifty by seventy-five feet. This fact I observed on my second visit, but not until the third or fourth

FIGURE 3A. CRYSTALLIZED GOLD. From Grit claim, El Dorado County, August 1865. Specimen is approximately 11 inches across. *Donated to California Division of Mines (SMB 21142) by Marie E. E. Berton (nee Fricot) in memory of her father, Jules Fricot, August 18, 1943. Photo by W. W. Bradley.*

FIGURE 3B. GOLD LEAF ON QUARTZ. Specimen approximately 4 inches across, in Harvard University Collection. *Photo courtesy Ward's Natural Science Establishment, Inc., W341.*

FIGURE 4A. ESSONITE. With tourmaline on albite (cleavelandite), from Ingle's mine, Ramona, San Diego County. Specimen approximately 5½ inches across; in Harvard University Collection. *Photo courtesy Ward's Natural Science Establishment, Inc., W284.*

FIGURE 4B. GEM TOURMALINE. With quartz crystals and cleavelandite, from Mesa Grande, San Diego County. Specimen approximately 10 inches across; in Harvard University Collection. *Photo courtesy Ward's Natural Science Establishment, Inc., W303.*

visit did I ascertain that the water contained a considerable quantity of borax, along with an excess of boracic acid. From a gallon I obtained four hundred and eighty-eight grains of solid matter, consisting of borax, boracic acid, and a small portion of siliceous and other earthy impurities. On digging to a slight depth just outside the lake, the hot water burst up and ran off freely. From one of these places a stream issued of sixty gallons per minute. I have estimated the entire quantity at three hundred gallons per minute, and feel very confident of being largely within bounds. The stream seems to come from the direction of the sulphur bank, and it would probably be easy to intercept it before it enters the lake, by digging a little above high-water mark. It may be well to note here, that the difference between high and low water marks in Clear lake is never more than three feet.

"The enormous amount of borax these springs are capable of yielding would equal half the quantity of that article consumed both in England and America. The large quantity of water in which it is dissolved would, of course, involve the necessity of extensive works for evaporation. Graduation, as a cheap and effective method of evaporation, would be exceedingly applicable here, from the continued prevalence of winds throughout the entire year. These winds blowing almost unceasingly from the west, form a peculiar feature of the country about Clear lake.

"There is nothing to hinder the manufacture of many million pounds of borax per annum, at a cost but little beyond that of producing salt by graduation. Fuel for final evaporation could be had in any quantities from the extensive oak forest in the immediate vicinity. With these observations I dismiss this locality, adding, however, that Mr. Joseph G. Baldwin located this with a four hundred and eighty acre school land warrant, for the benefit of a borax company.

"Having wandered from my story of my second visit to the 'sulphur bank,' and blended with it observations made in several subsequent examinations, I now turn to my second visit to 'Alkali lake,' or Lake Kaysa, as the Indians call it. I need only say, however, I became fully satisfied of the great value of the locality, the extent of which has only been recently developed. I observed that the lake itself contained but little water, but that wells dug anywhere near its margin immediately filled with the same kind of water; the conclusion, therefore, was, that an almost inexhaustible supply was obtainable. I learned, too, that what seemed to be mud at the margin and shelving off and covering the entire bottom to the depth of some feet, was a peculiar jelly-like substance of a soapy feel and smell. This matter I found to be so rich in borax, that I supposed it might be advantageously used for the extraction of the mineral. Thus satisfied of the value of the lake, I little thought that within a few yards of me lay an additional value in the form of millions of pounds of pure borax crystals, hidden by the jelly-like substance I was then contemplating. This important fact was not observed until some six months afterwards.

"This locality is by far the most important of any I have yet discovered. It is situated * * * in the angle formed by the two prongs into which Clear lake is divided at its eastern extremity. The elevated hill land that fills the angle separates into two sharp ridges, each following its division of the lake and leaving a valley between, of a triangular shape, near the apex of which lies Alkali lake. Clear lake is, therefore, on two sides of it, distant to the north about a mile, and to the south about half the distance. The open part of the triangular plain looks to the east, and expands into an extensive valley, from which it is cut off, partially, by a low volcanic ridge running across from one hill to the other, and thus enclosing the triangle.

"This ridge is composed of huge masses of rock resembling pumice-stone, which float like cork in water. A thin stratum of ashy-looking soil, scattered over with obsidian fragments, covers the ridge and affords root to a stunted growth of manzanita shrubs.

"The whole neighborhood bears marks of comparatively recent volcanic action. Indeed, the action has not ceased entirely yet; hot sulphurous fumes issue from several places on the edge of the ridge just named, on the side next Alkali lake.

"The 'lake,' as it is called, is rather a marsh than a lake. In winter it covers some two hundred acres, with about three feet depth of water. In the dry portion of the year it shrinks to some fifty or sixty acres, with a depth of only a few inches. The 'soapy matter' covers the entire extent with a depth of nearly four feet, the upper part, for a foot in depth, being in a state of semi-fluidity, the lower having the consistency of stiff mortar. Beneath this is a rather tenacious blue clay. This water was nearly as highly charged with solid matter as that of the lake in its highest summer concentration; the proportion of borax to other substances being greater. The soapy or gelatinous matter, however, presents the greatest feature of attraction, being filled with the prismatic crystals of pure borax. They vary from a microscopic size

up to the weight of several ounces. These crystals are semi-transparent, of a whitish or yellowish color. The form is an oblique rhomboidal prism, with replaced edges and truncated angles. In some cases the edges are bevelled, and in others the unmodified hexahedral prism exists. Beneath the gelatinous matter, and on the surface of the blue clay, and from sixteen to eighteen inches in it, crystals of a similar form, but much larger, are found. They weigh from an ounce, and seem to have been formed under different circumstances from the other crystals. My first impression was that they had been formed in the upper-stratum, and, sinking by their own gravity, had found their present position. An examination proves, however, that they were formed where they lie, as particles of the blue clay are found enclosed in their centres, which could not have been the case had the upper crystals been their nuclea, for no blue matter is ever found in them."

Following this discovery, very vigorous prospecting for borax was carried on all through the desert regions of California. The famous deposits of Death Valley were found in its playas in 1873, and less extensive ones in the Searles Lake basin in 1862. A number of other localities, of lesser importance, were also recorded, even in the early days.

Later (1882) the discovery was made of the immensely rich colemanite beds in Death Valley, along Furnace Creek; in the following year colemanite was found in the Calico district. Other important deposits of this mineral were discovered as time went on at Frazier Mountain, Ventura County (1898), Tick Canyon, Los Angeles County (1909), and in the Kramer district, Kern County (1913). These deposits were the principal source of borax until the discovery of kernite in the Kramer district in 1927. This area, with Searles Lake, now (1955) produces practically all the borax in California.

Searles Lake Deposits

Discovery of the Searles Lake borax deposits is described in the following quotations from De Groot (3) p. 534 and Gale (13) p. 309.

"This extensive and valuable deposit of borax was discovered by John W. Searles, who first observed signs of this salt when crossing the marsh that now bears his name, in 1862, at which time he was engaged in prospecting for gold in the Slate Range, lying to the east. Being unacquainted with the nature of the substance, he did not at the time pay much attention to it. Afterward, however, when borax began to be an object of general inquiry, he recognized in some samples of this salt shown him the stuff he had noticed while crossing this alkaline flat several years before. Satisfied on this point, he at once took proper steps for locating such portions of the marsh as he considered most valuable." De Groot (3) p. 534.

"The deposit is reported to have been located by J. W. Searles and E. M. Skillings on February 14, 1873. Borax was then obtained from the surface scrapings over the mud deposits about the margin of the main salt area * * * ." H. S. Gale (13) p. 309.

In his report, H. S. Gale (13) pp. 271, 272, describes the geologic setting of the deposits as follows:

"The most distinctive feature of this desert basin is the immense sheet of solid white salts that lies exposed in its bottom. It is to this salt deposit that the name Searles Lake (Searles Dry Lake) has generally been applied. So far as known at present the deposit is unique in this country in the variety of its saline minerals * * * ."

"The surface of the main or central salt deposit is a firm crust of salt crystals, mostly cubic halite, so hard and compact that it will support the weight of a * * * heavy drill rig. The surface shows a tendency to crack along irregular lines, so that it is divided into cakes or blocks. Flooding and re-solution tend to level inequalities that arise and the cakes and fractures are not so pronounced a feature here as they are on some salt surfaces of similar type elsewhere."

The following description of the mineralogy of the Searles Lake deposits is also drawn from Gale's report (13) pp. 296, 297:

"Of the commoner minerals characteristic of desert-basin salines generally, probably the greater number are represented in the Searles Lake deposits, except ulexite, which is reported to be absent.

"The deep well at Searles Lake, which was begun in 1887 and completed in 1896 * * * has proved a veritable treasure house of unusual and entirely new minerals, including several that have never been found at any other place. The less soluble minerals were mostly found embedded in the muds or clay at the margin or underlying the main saline deposit. Several are characteristically found in small but distinctly formed crystals, many of which are unattached, as if they had grown within the mud. In places, however, layers of the crystalline material (as pirssonite) have become so consolidated as to present hard strata, offering considerable difficulty in drilling. Many of the specimens obtained as drill samples are fractured masses or even finely granulated material, but much perfectly preserved crystalline material has also been obtained in this way."

The following is a compiled list of minerals reported from Searles Lake through 1945:

Anhydrite	Glauberite	Quartz
Borax	Gold	Realgar
Burkeite	Gypsum	Schairerite
Calcite	Halite	Searlesite
Celestite	Hanksite	Sulphohalite
Cerargyrite	Mirabilite	Sulphur
Colemanite (error)	Nahcolite	Thenardite
Embolite	Natron	Trona
Dolomite	Northupite	Tychite
Gay-lussite	Pirssonite	Ulexite

CRESTMORE

The more than 100 minerals from the famous Crestmore locality near Riverside are found in a cluster of quarries grouped about Chino and Sky Blue Hills (Chino, Wet Weather, Lone Star, Commercial), which have exposed extensive contact zones in limestone, formed by intrusive plutonic and dike rocks. The following abstract and list of minerals have been taken from Woodford (11) pp. 333, 334, 350-353, where also a fairly complete bibliography may be found, (p. 364).

"In the contact zones the most abundant minerals are garnet, diopside, idocrase, wollastonite, monticellite, and spurrite, the last named as a principal constituent of a fine-grained rock which also includes monticellite and other minerals. Nine new species have been described from Crestmore, all as primary or secondary constituents of the contact zones. These minerals are wilkeite, crestmoreite, riversideite, plazolite, jurupaite, merwinite, foshagite, tilleyite and ellestadite."

In the limestone beyond the contact zones, disseminated brucite grains are locally abundant and graphite flakes are more rarely present.

"The pegmatites, especially those associated with the relatively small masses of intrusive quartz monzonite porphyry, have some unusual constituents, such as laumontite and other zeolites, andradite garnet, axinite, thulite, the rare-earth mineral allanite, and the thorium-bearing 'Mineral L.'

"Something as to the nature and intensity of the metamorphism is indicated by the close association of the silicate contact rocks with pegmatites, by the contamination of the fine-graned porphyry at and near limestone contacts, by the absence of dolomite and tremolite from the crystalline limestone, and by the presence in the contact zones of diopside, wollastonite, monticellite, spurrite, and merwinite.

"A cement plant was started in 1909 at Crestmore, near Riverside, 50 miles east of Los Angeles. Crystalline limestone and other rocks were quarried from the twin Crestmore Hills for use in the manufacture of cement and for other purposes.

"In 1914 Professor A. S. Eakle of the University of California called the attention of mineralogists to the numerous contact minerals which were being found at this promising locality. In the next two or three years Professor Eakle, Professor A. F. Rogers of Stanford, Mr. R. M. Wilke of Palo Alto, and especially Mr. L. J. Childs of Rialto, collected many fine specimens of grossularite, diopside, wollastonite, idocrase, and other minerals from the limestone contact zone. In 1914 Eakle and Rogers

described the complex new mineral wilkeite, in 1917 Eakle published a general paper on the locality, and in 1918 Rogers reported periclase. The first period of good collecting came to an end in 1916 or 1917.

"Important Crestmore discoveries were made by W. F. Foshag and E. S. Larsen in the twenties, including spurrite, thaumasite, centrallasite and the new minerals merwinite and plazolite. In the thirties M. A. Peacock distinguished parawollastonite, using Crestmore material, Duncan McConnell reported on members of the apatite group, recognizing ellestadite as a new end-member, and Larsen and Dunham described the new mineral tilleyite.

"In 1938 new quarrying in the principal contact zone exposed not only minerals previously listed from the locality, but also many others. Part of the new finds are from the limestone contact and part are from the white dikes of intrusive pegmatite. A report on these finds was made in the *American Mineralogist* (Woodford, Crippen, and Garner, 1941)".

The following is a list, complete to date, of known minerals from this locality, not including a number of new, and as yet incompletely described species.

1 Actinolite
2 Afwillite
3 Albite
4 Allanite (Treanorite)
5 Andradite garnet
6 Andesine
7 Anglesite
8 Apatite
9 Apophyllite
10 Aragonite
11 Arsenopyrite
12 Augite
13 Axinite
14 Azurite
15 Biotite
16 Bornite
17 Bultfonteinite
18 Brueite
19 Bytownite-anorthite
20 Calcite
21 Centrallasite
22 Cerussite
23 Chalcedony
24 Chalcocite
25 Chalcopyrite
26 Chondrodite
27 Chrysocolla
28 Chrysotile
29 Chlorite
30 Clinochlore
31 Clinozoisite
* Crestmoreite (see tobermorite)
32 Cuprite
33 Custerite
34 Danburite
35 Datolite
36 Deweylite
37 Diallage
38 Diopside
39 Dolomite
40 Ellestadite
41 Epidote
42 Forsterite
43 Foshagite
44 Galena
45 Gehlenite
46 Gonnardite
47 Graphite
48 Greenockite; var. xanthochroite
49 Grossularite garnet
50 Gypsum (selenite)
51 Hornblende
52 Hematite
53 Hydromagnesite
54 Hydrotroilite
55 Hypersthene
* Jurupaite (see xonotlite)
56 Kaolinite (?)
57 Labradorite
58 Laumontite
59 Loellingite
60 Limonite
61 Ludwigite (?)
62 Magnesite (?)
63 Magnesioferrite
64 Magnetite
65 Malachite
66 Manganite (?)
67 Merwinite
68 Microcline
69 Molybdenite
70 Monticellite
71 Montmorillonite
72 Muscovite
73 Nasonite
74 Nontronite
75 Okenite
76 Oligoclase
77 Opal (common) (hyalite)
78 Orthoclase
79 Paigeite (?)
80 Pargasite (?)
81 Periclase
82 Perovskite
83 Phillipsite
84 Phlogopite
85 Plazolite
86 Prehnite
87 Ptilolite
88 Pyrite
89 Pyrrhotite
90 Quartz
91 Realgar
* Riversideite (see tobermorite)
92 Rutile
93 Scapolite
94 Seawtite
95 Sepiolite
96 Sericite
97 Serpentine
98 Sphalerite
99 Sphene
100 Spinel
101 Spurrite
102 Stibnite
103 Stilbite
104 Strontianite
105 Talc (?)
106 Tetrahedrite
107 Thaumasite
108 Thorite
109 Tilleyite
110 Tobermorite
111 Tourmaline, brown
112 Tourmaline; var. schorl
113 Tremolite (?)
114 Uralite
115 Vermiculite
116 Vesuvianite
117 Wilkeite
118 Wollastonite
119 Xanthophyllite
120 Xonotlite
121 Zircon
122 Zoisite; var. thulite

*Discredited species.

PEGMATITE GEM AREA OF SOUTHERN CALIFORNIA

Over a considerable area in southern California, extending from San Jacinto Mountain to the Mexican line, the pegmatite dikes are in many cases distinguished by a relatively high concentration of lithium, with the result that many lithium minerals are present, such as spodumene, amblygonite, lepidolite, and the lithia-rich variety of tourmaline. This variety of tourmaline is typically more or less transparent, colorless, blue, pink, or green, and when clear becomes of value as a source of gem material. A relatively small percent of the pegmatites in this area are lithia-bearing, but even so, there are a considerable number which have produced gem tourmaline, sometimes in fairly large amount. Associated with the tourmaline are other gem minerals, such as beryl, topaz, kunzite (the transparent lilac spodumene) and occasionally clear garnet, and some of the not inconsiderable gem production has come from these varieties.

In general, the pegmatites are more or less irregular dikes in form, intruded into igneous rocks of the granodiorite type, or into schists closely associated with such rocks. They are not large, at least in the case of the gem-bearing dikes. Fifteen feet or so is probably near the maximum thickness, and many are considerably narrower. Mineralogically, they are composed mainly of quartz, albite and microcline, with minor amounts of garnet, muscovite or biotite, and occasional concentrations of lithia minerals. Those carrying gem minerals are often characterized by cavities, in which quartz, tourmaline, topaz, etc., have had opportunity to crystallize freely. It is suggested by various writers that these gem-bearing dikes have been re-worked by later lithia-rich solutions, after their original intrusion as common pegmatites. In a few cases, notably at Pala, Rincon, and Ramona, the pegmatites show a curious "line" structure, which gives the effect of stratification roughly parallel to the dike walls. This pattern has not been satisfactorily explained as to its origin, but it is produced by the concentration of tiny garnet crystals in sheets in a fine-grained facies of the dikes.

The details of individual pegmatites have been well treated by Kunz (24), and the following has largely been quoted or abstracted from this source.

The gem-producing localities are as follows: near the summit of the San Jacinto Range, in Riverside County; Coahuila Mountain, Aguanga Mountain, Pala, Mesa Grande, and Ramona; also minor occurrences east of Julian, and in the Chihuahua Valley. In addition, gem-quality garnet was found in the Jacumba area.

"The first discovery of colored gem-tourmaline in the State goes back as far as 1872, when Mr. Henry Hamilton, in June of that year, obtained and recognized this mineral in Riverside County, on the southeast slope of Thomas Mountain. These colored tourmalines, now found at a number of points, were not encountered by Professor Goodyear, who particularly noted the black tourmalines in the pegmatite veins, in his geological tour through San Diego County, in the same year, referred to above; but his reconnaissance was a little south of the gem-tourmaline belt. Some mining was done at this point, and fine gems were obtained. In the course of years, three localities were opened and more or less worked in this vicinity; so that in the author's report on American gem-production for 1893, the following statement appeared:

"'Tourmalines are mined at the California gem mine, the San Jacinto gem mine, and the Columbian gem mine, near Riverside, California. These three mining claims cover the ground on which the tourmaline is found, and are situated in the San Jacinto range of mountains in Riverside County, California, at an altitude of 6500 feet, overlooking Hemet Valley and Coahuila Valley, and 27 miles from the railroad.

The formation in which the crystals are found is a vein from 40 to 50 feet wide running almost north and south through the old crystalline rocks which make up the mountain range. The vein in some places consists of pure feldspar, or else feldspar with quartz, in others all mica, and in others rose-quartz and smoky quartz. The tourmalines vary in size from almost micrograins to crystals 4 inches in diameter. They are most plentiful in the feldspar, but are found in other portions of the vein, sometimes in pockets and sometimes isolated. The larger crystals generally have a green exterior and are red or pink in the center. Some of the crystals contain green, red, pink, black, and intermediate colors; others again are all of uniform tint—red, pink, colorless, or blue. Associated with the tourmalines are rose-quartz, smoky quartz, asteriated quartz, and fluorite, and some of the quartz was penetrated with fine, hair-like crystals of tourmaline, strikingly like a similar occurrence of rutile.'

"It may seem remarkable that this locality of gem-tourmalines should have been unrecorded in the earlier lists of California minerals given by such authorities as Professor Blake and Mr. Hanks in the reports of the State Mining Bureau for 1882 and 1884. But the parties who knew of the occurrence did not make it public for some years, and the earlier specimens were taken out quietly and their locality not divulged. The writer had positive knowledge as to the facts, however, and possesses a fine specimen obtained prior to 1873.

"The second important discovery in this region was made, or at least announced, twenty years later, in 1892, by Mr. C. R. Orcutt—the great locality of lithia minerals at Pala. Some allusions to red tourmaline from uncertain sources in this part of the State had appeared before, but nothing very specific. In the list of California minerals prepared by Prof. William P. Blake in 1880-82, and also quoted in that of Mr. Henry G. Hanks, published in 1884, references are made to the recent discovery of rubellite, for the first time in the State, associated with lepidolite, 'in the San Bernardino range, southern California.' The general description is precisely that of the Pala specimens, but the location is very indefinite. Mr. Hanks refers to the same association under lepidolite, and mentions a specimen in the State Mineral Bureau, from San Diego County, and remarks that 'this may at some future time be found profitable to extract lithium from it'—a prediction abundantly verified now. Mr. Orcutt, however, was the first to make the locality known. It was noted by the author in his report for 1893 where the following account was given:

" 'Mr. Charles Russell Orcutt has announced a new and remarkable occurrence of pink tourmaline in lepidolite, similar to that of Rumford, Maine, 12 miles south of Temecula, near San Luis Rey River, in San Diego County, the southern county of California, and it has already become celebrated from the abundance and beauty of the specimens yielded, as much as twenty tons having been sent East for sale.'

"In regard to the early history of this locality, Mr. F. M. Sickler, who grew up in the vicinity and has explored for mines and minerals thereabout a great deal, relates the following curious and somewhat romantic circumstances, in an article in the Kansas City *Jeweler and Optician*, of May, 1904. He states that the Pala lepidolite deposit had very long been known to the Indians, but that it was first brought to the notice of the whites by an Indian deer-hunter named Vensuelada. He found the spot while hunting and broke off pieces showing the beautiful pink rubellite in its matrix of pearl-colored lepidolite, and brought them to Pala. Henry Magee, an old miner and prospector, took the rubellite crystals for cinnabar, and located the property as a quicksilver mine. Failing to get any mercury from it, he nevertheless believed that the peculiar mineral must have some value, and sent samples to various chemists, but no one recognized it as a lithia compound of any importance. Weary of his poor success, Magee gave it up and failed to do the annual assessment work on the claim. Later, one Thomas Alvarado relocated the property as a marble quarry! Magee claimed that some interest in the mine was rightfully due to himself, but Alvarado refused to give him any. Upon this, Magee pointed eastward to the ridge now called Heriart Mountain, and said, 'If this stuff is of any value, I know where there are thousands of tons of it over there.' Magee died, however, and his secret died with him; but certain it is that several mines, with lepidolite and tourmaline, have lately been located on that very ridge. * * *

"In Pala, a little west of Smith's Mountain, in the Peninsula range, * * * a ledge of lepidolite containing rubellite has been traced for over half a mile. It consists of a coarse granite, penetrating a norite rock, and including masses of pegmatite. Small garnets occur in the granite, and black tourmaline, with a little green tourmaline. The lepidolite appears in the southern portion, finally forming a definite vein which at one point is twenty yards wide. The rubellite is chiefly in clusters and radiations, several inches in diameter, also occasionally as single crystals, and the

specimens of deep pink tourmaline in the pale lilac mica are remarkably elegant. About eighteen tons were mined during 1892.

"The next important discovery was made six years later, in 1898; this was the wonderful Mesa Grande locality, some 20 miles southeast of Pala. There are various stories about the Indians having known it for many years, and the most familiar account follows:

"The first discovery in San Diego County is thought to have been made about twenty-five years ago [1880], when some Indian children, at play in a camp near what is now Mesa Grande postoffice, picked up an oddly shaped stone, six-sided like a quartz crystal, about three inches long and a little thicker than a common lead-pencil. On cleaning it off and rubbing it with a bit of hide, it was seen to be of a beautiful blue color, bright and partially clear, almost like a sapphire. The natives had no idea of its nature, but were attracted by its beauty and singularity. Subsequently, other highly colored stones of like character—some blue, others green, others red—were picked up in the same vicinity by Indians and cowboys, but no one realized that they had any actual value. * * *

"The fact that some of the highly colored crystals are found in Indian graves in the vicinity, suggests that they may have been known and valued perhaps for a very long time. The ledge in which they occur is exposed by erosion on the side of the mountain; and the natives had certainly learned where to find crystals, and had them in their possession for some years before the whites knew anything about them. It is even said that they had learned to do a little rude blasting, and thus to reach the cavities in which the minerals occur. It was not until 1898, however, that this now famous locality was made known to the world. * * *

"For several years, these above noted were the only gem mines of this region, and their product was highly esteemed. But in 1902 began a succession of new discoveries that have attracted great attention. On Pala Chief Mountain and on Heriart Mountain began to be found not only fine-colored tourmalines, but the novel and remarkable gem-spodumene, designated as kunzite. This last-named mineral was found by Mr. Frederick M. Sickler, at which is now known as the White Queen mine, on Heriart Mountain, east of Pala, early in 1902; it is claimed, indeed, that he had obtained one or two pieces some time before, but it was not identified. In July 1902, Mr. Sickler visited San Diego and Los Angeles, and showed specimens to local jewelers and collectors, none of whom recognized it. The first determination was made by the writer, from specimens sent by Mr. Sickler early in 1903.

"The great Pala Chief mine, which has given its name to the middle one of the three ridges or mountains at Pala, and has yielded magnificent tourmalines and the largest and finest gem-spodumene crystals, was located in May, 1903, by Frank A. Salmons, John Giddens, Pedro Peiletch, and Bernardo Heriart. The actual discoverers were probably the two last named, the Basque prospectors who had already been working and locating claims with the two Sicklers, father and son, on Heriart Mountain, the ridge a little to the east. Mr. Salmons has been the principal operator, however, of this very notable mine."

CERRO GORDO

The Cerro Gordo district lies near the summit of the Inyo Range, 5½ miles by air line and 8 miles by a steep mountain road from Keeler, on the shore of Owens Lake. The district was discovered by Mexican prospectors in the early sixties (1861 or 1866), but no great production was reached until the area was taken over by Americans in 1869. During the next eight years the total production was estimated at anywhere from $6,500,000 to $20,000,000, with the probable truth somewhat near the lower figure. In this period, the bonanza silver-lead ores were worked out, and mining lapsed until the discovery of extensive zinc-carbonate ores about 1911, which led to a revival of activity. It is interesting to note that in 1871-72 a small steamer on Owens Lake (?) carried bullion from the Swansea smelter across to the south shore, thus saving a long trip around by road. R. W. Raymond (6) p. 21. The region consists of a series of westward-dipping Carboniferous rocks (mainly limestone) with intrusive dikes of diorite and monzonite, nearly parallel to the bedding. An underlying mass of monzonite

porphyry outcrops to the north of the mines. At Cerro Gordo itself, the mines are the Union and Santa Maria. Other nearby mines in the district include the Ignacio and Ventura, to the west and south.

The primary ores were mainly argentiferous galena, with a very little dark sphalerite. The rich ores worked in the early days consisted of lenticular masses of massive cerussite, 5 or 6 feet across, in the limestone. These masses were concentrically banded, and usually had a small core of unaltered galena. The zinc from the sphalerite was concentrated as large masses of relatively pure smithsonite, also in the limestone. In one primary vein, tetrahedrite and pyrite were prominent.

The uncommon minerals for which the area is noted were formed by the oxidation of the original minerals. Some of these secondary minerals, such as linarite, azurite, and caledonite are bright colored and showy. Others, including some of the rarer varieties, are less conspicuous. A good description of the geology and minerals of the area may be found in A. Knopf (5) and (8).

The following list includes all species recorded from the Cerro Gordo mines:

Anglesite	Cerussite	Mimetite
Anhydrite	Chrysocolla	Plumbogummite (?)
Argentite	Galena	Pyrite
Atacamite	Halloysite	Quartz
Aurichalcite	Hemimorphite	Silver
Azurite	Hydrozincite	Smithsonite
Barite	Leadhillite	Sphalerite
Bindheimite	Limonite	Stibnite
Calcite	Linarite	Tetrahedrite
Caledonite	Liroconite (?)	Willemite
Cerargyrite	Malachite	

The following list includes occurrences in the other mines of the Cerro Gordo district:

Bournonite	Goethite	Stromeyerite
Cervantite	Greenockite (?)	Tetradymite
Dufrenoysite	Jamesonite	Wulfenite
Fluorite	Pyromorphite	

Cinnabar and metacinnabar were wrongly reported from this Cerro Gordo mine through confusion with another Cerro Gordo mine in San Benito County.

Some of the minerals supposedly from this locality may have been from some distance away, since the smelter treated ores from outside the district, and specimens of these may easily have been confused with true Cerro Gordo material.

THE GLAUCOPHANE SCHISTS

Throughout the Coast Ranges of California, from Mendocino County in the north to San Diego County in the south, the rocks of the Franciscan formation are characterized by the occurrence of numerous small areas of rock rich in glaucophane, the so-called "glaucophane schists". This rock type occurs in other parts of the world, but probably nowhere as extensively as in California.

The glaucophane schists are usually more or less strongly schistose, thus justifying the name; less commonly, they are granulose in texture and are more typical eclogites. Mineralogically they are exceptionally

rich, some 30 minerals having been identified in greater or less abundance. The more common of these include actinolite, glaucophane, gastaldite, crossite, jadeite, crocidolite, and lawsonite. In addition garnet is locally abundant in the eclogites, accompanied by omphacite. Sphene is widespread in small amounts, and is occasionally in considerable concentration.

The glaucophane rocks are distributed in discontinuous areas along the Coast Ranges, apparently always bordering serpentine or similar ultrabasic intrusives. Their occurrence is not uniform even around these intrusives, but irregularly localized along the contact. The problem of their origin has received considerable attention in a number of papers, of which those by J. P. Smith (1), Taliaferro (5), Switzer (5) and Brothers (1) are the most important. In the earlier days it was considered probable that they had been formed by regional metamorphism, but fuller investigation has shown that this origin is highly improbable. A much more plausible explanation of their origin is indicated by the following series of characteristics: (1) they occur sporadically; (2) they have a rather consistent character regardless of the kind of rock in which they are formed; (3) the local distribution of minerals is irregular, often veinlike in appearance; (4) chemical and mineralogic evidence of the addition of extra elements, notably sodium, to the deposits. These features point quite conclusively to a hydrothermal origin, and it seems quite safe to assume this is the case, even for those occurrences where there are no intrusive rocks in the immediate vicinity.

The principal localities for the individual minerals occurring in these schists are listed under the several species in the main part of this volume. It has been considered impracticable to attempt the listing of all occurrences.

URANIUM AND RARE-EARTH MINERALS

The great increase in interest and importance of radioactive and rare-earth minerals makes desirable a section on these occurrences. Occurrences in California are being reported with such rapidity, with new and unconfirmed reports of discoveries of uranium minerals appearing almost weekly in the public press, that any section on these minerals, if it more than lists the names and occurrences would be hopelessly outdated before this bulletin could be off the press. Accordingly, listed below are the confirmed occurrences of minerals of the radioactive group as of December 30, 1954.

Rare-earth mineral occurrences of California.

Allanite	Hyblite (thorogummite)	Thorite
Autunite	Hydrothorite (thorogummite)	Thorogummite
Bastnaesite	Mackintoshite (thorogummite)	Torbernite
Betafite	Maitlandite (thorogummite)	Treanorite (allanite)
Brannerite	Meta-autunite (autunite)	Uraconite
Curite (gummite)	Nicolayite (thorogummite)	Uraninite
Cyrtolite	Orangeite (thorite)	Uranthorite (thorite)
Euxenite	Parisite	Xenotime
Fergusonite	Perovskite	Yttrocrasite
Gummite	Sahamalite	Samarskite

For information of a general nature directed toward California occurrences the reader is referred to *Mineral Information Service,* vol. 7, no. 7, for July 1, 1954, published by the California Division of Mines.

The U. S. Atomic Energy Commission and the United States Geological Survey publication *Prospecting for Uranium* offers general information. Information on the status of reported California occurrences subsequent to this publication may be obtained by inquiry to the California Division of Mines, Ferry Building, San Francisco 11, California.

THE DANA CLASSIFICATION OF CALIFORNIA MINERALS

NATIVE ELEMENTS

Gold
Electrum
Maldonite (bismuth-gold)
Silver
Copper
Lead
Mercury
Gold amalgam
Platinum
Platiniridium
Iridosmine
Siserskite
Iron
Awaruite (nickel-iron)
Tin
Zinc
Arsenic
Antimony
Bismuth
Tellurium
Sulphur
Diamond
Graphite

SULPHIDES

Tetradymite
Nagyagite
Argentite
Naumannite
Eucairite
Hessite
Petzite
Chalcocite
Stromeyerite
Bornite
Galena
Altaite
Alabandite
Sphalerite
Metacinnabar
Tiemannite
Coloradoite
Chalcopyrite
Stannite
Wurtzite
Greenockite
Pyrrhotite
Troilite
Hydrotroilite
Niccolite
Millerite
Pentlandite
Cubanite
Covellite
Cinnabar
Realgar
Violarite
Orpiment
Stibnite
Metastibnite
Bismuthinite
Kermesite
Pyrite
Cobaltite
Gersdorffite
Loellingite
Marcasite
Arsenopyrite
Molybdenite
Calaverite
Sylvanite
Melonite
Smaltite

SULFOSALTS

Polybasite
Stephanite
Pyrargyrite
Proustite
Pyrostilpnite
Tetrahedrite
Tennantite
Famatinite
Enargite
Geocronite
Meneghinite
Bournonite
Boulangerite
Miargyrite
Dufrenoysite
Kobellite
Jamesonite
Berthierite
Franckeite

OXIDES

Cuprite
Water
Periclase
Tenorite
Montroydite
Litharge
Massicot
Minium
Corundum
Hematite
Turgite
Ilmenite
Arsenolite
Senarmontite
Claudetite
Valentinite
Braunite
Rutile
Chromrutile
Pyrolusite
Cassiterite
Anatase
Brookite
Cervantite
Stibiconite
Stetefeldite
Partzite
Bismite
Stibioferrite
Ilsemannite
Tungstite
Uraninite
Gummite
Brucite
Pyrochroite
Manganite
Sassolite
Gibbsite (bauxite)
Psilomelane
Diaspore
Goethite
Limonite
Spinel
Magnesioferrite
Magnetite
Chromite
Hausmannite
Chrysoberyl
Crednerite
Coronadite
Microlite
Pyrochlore
Fergusonite
Stibiotantalite
Brannerite
Columbite (tantalite)
Yttrocrasite
Samarskite
Betafite

HALIDES

Halite	Calomel	Eglestonite
Cerargyrite	Fluorite	Atacamite
Bromyrite	Chloromagnesite	Kempite
Salammoniac	Coccinite	Creedite

CARBONATES

Nahcolite	Ankerite	Bismutite
Trona	Alstonite	Artinite
Calcite	Thermonatrite	Azurite
Magnesite	Nesquehonite	Hydromagnesite
Siderite	Natron	Dawsonite
Rhodochrosite	Pirssonite	Northupite
Smithsonite	Gaylussite	Beyerite
Aragonite	Zaratite	Parisite
Witherite	Hydrozincite	Bastnaesite
Strontianite	Aurichalcite	Tychite
Cerussite	Malachite	Leadhillite
Dolomite	Phosgenite	Sahamalite

NITRATES

Soda niter	Nitrocalcite	Nitroglauberite
Niter	Darapskite	

BORATES

Ludwigite	Priceite	Meyerhofferite
Paigeite	Probertite	Inyoite
Hulsite	Ulexite	Howlite
Kernite	Veatchite	Bakerite
Tincalconite	Colemanite	Teepleite
Borax	Hydroboracite	Szaibelyite

Bechilite = ulexite
Vonsenite = Paigeite
Camsellite = Szaibelyite

SULPHATES

Mascagnite	Tschermigite	Brochantite
Arcanite	Szomolnokite	Schairerite
Aphthitalite	Gypsum	Sulphohalite
Thenardite	Chalcanthite	Linarite
Barite	Pentahydrite	Alunite
Celestite	Siderotile	Natroalunite
Anglesite	Melanterite	Jarosite
Anhydrite	Pisanite	Plumbojarosite
Glauberite	Boothite	Amarantite
Mirabilite	Bieberite	Hohmannite
Kroehnkite	Epsomite	Fibroferrite
Bloedite	Goslarite	Botryogen
Leonite	Morenosite	Metavoltine
Boussingaultite	Roemerite	Copiapite
Ferrinitrite	Pickeringite	Magnesiocopiapite
Krausite	Halotrichite	Hanksite
Voltaite	Redingtonite	Caledonite
Mendozite	Coquimbite	Burkeite
Potash alum	Alunogen	

SELENITES AND TELLURITES

Emmonsite

CHROMATES

Crocoite	Vauquelinite

PHOSPHATES, ARSENATES, AND VANADATES

Triphylite	Scorodite	Dehrnite
Lithiophilite	Metastrengite	Wilkeite
Ferrisicklerite	Jezekite	Ellestadite
Sicklerite	Descloizite	Lazulite
Heterosite	Cuprodescloizite	Scorzalite
Purpurite	Calciovolborthite	Bayldonite
Beryllonite	Amblygonite	Wardite
Xenotime	Plumbogummite	Turquoise
Monazite	Triplite	Arseniosiderite
Hureaulite	Adamite	Vauxite
Stewartite	Augelite	Torbernite
Salmonsite	Dufrenite	Autunite
Anapaite	Fluorapatite	Metatorbernite
Vivianite	Chlorapatite	Meta-autunite
Erythrite	Hydroxylapatite	Woodhouseite
Annabergite	Carbonate-apatite	Diadochite
Variscite	Pyromorphite	Pitticite
Strengite	Mimetite	
Koninckite	Vanadinite	

ANTIMONATES

Bindheimite

MOLYBDATES AND TUNGSTATES

Huebnerite	Powellite	Ferrimolybdite (molybdite)
Wolframite	Stolzite	
Ferberite	Wulfenite	
Scheelite	Cuprotungstite	

ORGANIC COMPOUNDS

Napalite	Amber	Posepnyte
Curtisite (Aragotite)	Idrialite	Gilsonite

SILICATES*

Tectosilicates

Quartz	*Feldspar group*	*Zeolites*
Tridymite	Orthoclase	Analcime
Cristobalite	Celsian	Chabazite
Lechatelierite	Microcline	Thomsonite
Opal	Albite	Gonnardite
Pollucite	Oligoclase	Edingtonite
Nepheline	Andesine	Clinoptilolite
Danburite	Labradorite	Ptilolite
Dumortierite	Anorthite	Natrolite
Bavenite		Scolecite
Petalite		Mesolite
		Laumontite
		Phillipsite
		Stilbite
		Stellerite
		Epistilbite
		Brewsterite
		Heulandite
		Haüyne
		Lazurite
		Helvite
		Scapolite
		Datolite

* Listing of the silicates follows the classification based on crystal structure used by Winchell, A. N., Elements of optical mineralogy, pt. 2, 4th ed., 1951.

Phyllosilicates

Gillespite
Sanbornite
Okenite
Prehnite
Bementite
Pyrophyllite
Kaolinite
Talc
Muscovite
Alurgite
Damourite
Sericite
Gümbelite
Fuchsite
Mariposite
Roscoelite

Lepidolite
Biotite
Phlogopite
Lepidomelane
Glauconite
Celadonite
Cookeite
Chrysotile
Deweylite
Garnierite

Serpentine
Chlorite
Antigorite
Penninite
Clinochlore
Prochlorite
Chalcodite
Stilpnomelane
Ganophyllite
Xanthophyllite
Margarite
Chloritoid
Ottrelite
Seawtite

Apophyllite
Gyrolite
Centrallasite

Vermiculite
Tobermorite
Montmorillonite
Beidellite
Chloropal
Saponite
Anauxite
Halloysite

Inosilicates

(Pyroxene group)
Enstatite
Hypersthene
Diopside
Diallage
Hedenbergite
Augite
Acmite
Jadeite
Aegerite
Spodumene

(Hydrous)
Chrysocolla
Riversideite
Crestmoreite
Jurupaite
Searlesite
Inesite
Neotocite
Sepiolite
Zoisite
Clinozoisite
Epidote
Piedmontite
Allanite

(Cyclosilicates)
Benitoite
Dioptase
Xonotlite
Wollastonite
Rhodonite
Pectolite
Joaquinite
Neptunite
Beryl
Tourmaline
Cordierite

(Amphibole group)
Anthophyllite
Cummingtonite
Tremolite
Actinolite
Hornblende
Edenite
Glaucophane
Crossite
Riebeckite
Arfvedsonite
Barkevikite
Croeidolite

Sorosilicates

Gehlenite
Afwillite
Nasonite
Custerite
Tilleyite
Hemimorphite
Lawsonite

Nesosilicates

(*Garnet group*)
Pyrope
Almandite
Spessartite
Uvarovite
Grossularite
Andradite
Plazolite
Zircon
Cyrtolite
Thorite
Thorogummite
Willemite
Forsterite
Olivene
Fayalite
Tephroite
Monticellite
Merwinite
Axinite
Hillebrandite (foshagite)
Iddingsite
Vesuvianite
Topaz
Ilvaite
Chondrodite
Clinohumite
Alleghanyite
Spurrite
Bultfonteinite
Pumpellyite
Sillimanite
Andalusite
Staurolite
Sphene
Serendibite
Kyanite
Allophane

DESCRIPTION OF CALIFORNIA MINERALS AND MINERAL LOCALITIES

ACANTHITE

See argentite

ACMITE

See pyroxene, soda pyroxene

ACTINOLITE

See amphibole

ADAMITE

Basic zinc arsenate, $Zn_3As_2O_8 \cdot Zn(OH)_2$

Orthorhombic. Small crystals, crusts, or granular aggregates. Brittle. Luster vitreous. Colorless, honey-yellow, violet rose-red, green. Streak white. H. = 3½. G. = 4.24-4.35.

Fusible. Soluble in hydrochloric acid.

Inyo County: **1**, Adamite occurs as small, colorless equant crystals on fracture surfaces of limestone, at Chloride Cliff in the Amargosa Range (T. 30 N., R. 1 E., S. B.). Crystals measured by Murdoch (5) p. 811.

San Bernardino County: **1**, Colorless, yellow and green crystals have been reported from the Mohawk mine, Crippen (p.c. '51).

ADULARIA

See feldspar, orthoclase

AEGIRITE

See pyroxene, soda pyroxene

AENIGMATITE

A titano-silicate of iron and sodium

Triclinic, prismatic; most crystals minute. Color black. G. = 3.8. Occurs in syenitic igneous rocks.

Sonoma County: **1**, Aenigmatite is found as minute prismatic phenocrysts in lavas, sec. 13, T. 7 N., R. 8 W., M.D., and sec. 17, T. 7 N., R. 7 W., M.D., Rose (p.c. '50).

AFWILLITE

Hydrous calcium silicate, $3CaO \cdot 2SiO_2 \cdot 3H_2O$

Monoclinic. Prismatic habit. Perfect basal pinacoidal cleavage. Colorless or white. G. = 2.63.

Riverside County: **1**, Crystals and massive afwillite occur in veins in complex contact rocks composed largely of merwinite, gehlenite, spurrite, calcite, etc., on the 910 level, Commercial Quarry, Crestmore, Switzer and Bailey (8) p. 629, Murdoch (30) p. 1347.

AGALMATOLITE

See muscovite; pyrophyllite

AGATE

See quartz, chalcedony

* Species first discovered in California are marked by an asterisk and followed by date of first published description.

ALABANDITE

Manganese sulphide, MnS

Isometric. Usually granular massive. Perfect cubic cleavage. Submetallic. Iron black to dark brown. Streak green. H. = 3½-4. G. = 3.95-4.04.

The roasted mineral gives a manganese bead with borax. Soluble in hydrochloric acid with the evolution of hydrogen sulphide.

Manganese occurs usually as oxides or oxygen compounds, but the sulphide is found occasionally as a vein mineral in metallic sulphide deposits, especially with sulphides of copper.

San Diego County: **1,** Specimens of alabandite have come from this county, perhaps from the Julian district (N. R.).

Santa Clara County: **1,** Alabandite was one of the manganese minerals in the boulder at Alum Rock Park, associated with hausmannite, tephroite, and others. A. F. Rogers (27) p. 206.

ALABASTER

See gypsum

ALBITE

See feldspar

ALLANITE—Orthite

Basic calcium-iron-aluminum-cerium silicate
$(Ca,Ce,La,Na)_2(Al,Fe,Mn,Be,Mg)_3(SiO_4)_3OH$

Monoclinic. Flat tabular crystals, also massive and in imbedded grains. Cleavage in two directions. Brittle. Pitchy luster. Color brownish black. H. = 5½-6. G. = 3.5-4.2.

Fuses easily with intumescence to a dark slag. Soluble in hydrochloric acid, yielding gelatinous silica.

Allanite is a minor constituent of granitic rocks. Treanorite is probably identical with allanite.

Calaveras County: **1,** Microscopic brown crystals of allanite were found on the 300-foot level of the Ford mine, half a mile east of San Andreas, A. Knopf (11) p. 35.

Los Angeles County: **1,** Abundant rough tabular crystals and grains of allanite as much as 2 to 3 inches in size occur in a pegmatite with zircon and apatite, in Pacoima Canyon, sec. 17, T. 3 N., R. 13 W., S.B., Neuerburg (2) p. 833.

Riverside County: **1,** Microscopic crystals and grains of allanite occur in the gneiss of the Eagle Mountain iron deposit, Harder (6) p. 28. **2,** It is also found with serendibite and associated minerals in the new city quarry 2 miles south of Riverside, Richmond (1) p. 725. **3,** Treanorite occurs in tabular, black crystals at Crestmore in pegmatites, Woodford et al. (10) and in black needles, Murdoch (p.c. '54).

San Bernardino County: **1,** Found in the bastnaesite occurrence at Mountain Pass, Pray (p.c. '51). **2,** Allanite is found in the border of a quartz mass in the Pomona Tile quarry on the road between Old Woman Spring and Yucca Valley, Hewett and Glass (3) p. 1048.

San Diego County: **1,** Found as black masses in quartz veins about 2 miles northwest of Pala on the hill about half a mile west of the road, Schaller (p.c. '25). **2,** Found in large rough crystals in a pegmatite on the N. S. Weaver ranch 3 miles north of Pala, R. M. Wilke (p.c. '36).

Santa Barbara County: **1**, Reported from Santa Barbara and the Channel Islands by Irelan (4) p. 47, S.M.B. (10974). **2**, From an unspecified locality in the county, L. G. Yates (2) p. 11.

Tulare County: **1**, Found in pegmatite, with rose quartz on the D. F. Gassenberger Ranch, northeast of Exeter, S.M.B. (19659).

Tuolumne County: **1**, Found in small amount in talus blocks from a pegmatite at the foot of Eagle Peak, on the northwest side of Yosemite Valley, Ries (1) p. 229. **2**, Crystals as much as 15 mm in size occur in a pegmatite in Lang Gulch, Hutton (3) p. 233. **3**, Crystals as much as 45 mm in size have been found in talus blocks of the Ragged Peak scree, ibid. (3) p. 236.

ALLEGHANYITE

Basic manganese fluosilicate, $Mn_5(SiO_4)_2(OH,F)_2$

Orthorhombic. In irregular grains. H. = 5.5. G. = 4. Color bright to grayish pink.

May be identical with tephroite.

Santa Clara County: **1**, Reported by A. F. Rogers (21) p. 443 from the Alum Rock Park manganese boulder; identity with tephroite suggested by C. S. Ross and Kerr (2) p. 13.

ALLOPHANE

Hydrous aluminum silicate, $Al_2SiO_5 \cdot nH_2O$

Amorphous. Incrustations. Very brittle. Vitreous luster. Pale sky blue, green, brown, colorless. Streak uncolored. H. = 3. G. = 1.85-1.89.

Infusible. Soluble in hydrochloric acid, yielding gelatinous silica. When heated with cobalt nitrate, assumes a blue color.

San Bernardino County: **1**, Allophane occurs in the veins of the California Rand silver mine, Hulin (1) p. 97.

San Luis Obispo County: **1**, A specimen has come from Arroyo Grande. (N. R.)

ALMANDITE

See garnet

ALSTONITE

See witherite; bromlite

ALTAITE

Lead telluride, PbTe

Isometric. Small octahedrons and massive. Metallic luster. Sectile. Color tin white to dark gray, with a yellowish tinge tarnishing to bronze yellow. H. = 3. G. = 8.16.

The yellow coating of lead aud the violet solution for tellurium serve to determine it.

Altaite is found associated with hessite, petzite, and gold tellurides in a few localities.

Calaveras County: **1**, In large masses with calaverite and hessite in the Stanislaus mines on Carson Hill (T. 2 N., R. 13 E., M. D.), Genth (5) p. 312. **2**, Also reported from the Morgan mine, Hanks, (12) p. 68, and **3**, the Frenchwood mine near Robinson's Ferry (sec. 25, T. 2 N., R. 13 E., M. D.), Hanks (12) p. 388, with other tellurides.

Madera County: **1**, About 200 yards east of the Chiquito trail and half a mile north of Fish Creek, in the North Fork mining district, W. W. Bradley (29) p. 311.

Nevada County: **1**, One of the minerals at the Providence mine, Nevada City, occurring in bunches in the Ural vein intergrown with native gold and associated with quartz, pyrite, and galena, Lindgren (12) p. **117. 2**, Found in the ore of the Champion mine, W. D. Johnston Jr. (3) p. 27. **3**, On the 5000-foot level of the Empire mine, in Grass Valley, W. D. Johnston, Jr. (4) p. 44.

Tuolumne County: **1**, Occurred in the Golden Rule mine near Tuttletown, Hanks (12) p. 68. **2**, Crystals cemented by gold came from the Barney pocket mine, Sawmill Flat near Columbia, Eakle (1) p. 324. **3**, Clusters of crystallized gold and altaite in parallel grouping were found in the Bonanza and O'Hara mines near Sonora, Sharwood (5) p. 26. **4**, Reported from the Adelaide mine by Hanks (12) pp. 68, 388, and from the Sell mine (sec. 30, T. 2 N., R. 15 E., M. D.) as gray crystals on crystallized gold, Foshag (p.c. '35).

ALUNITE

Basic hydrous sulphate of aluminum and potassium, $K_2Al_6(OH)_{12}(SO_4)_4$

Hexagonal-rhombohedral. Small crystals and massive. Basal cleavage distinct. Brittle. Vitreous luster. Color white, sometimes reddish. Streak white. H. = 3½-4. G. = 2.58-2.75.

Infusible and decrepitates. Turns blue when moistened with cobalt nitrate and intensely heated. Gives water in a closed tube. Slowly soluble in sulphuric but insoluble in hydrochloric acid.

Calaveras County: **1**, Small crystals found at Railroad Flat, W. W. Bradley (32) p. 565.

Colusa County: **1**, Massive alunite carrying gold collected at Sulphur Creek, Woodhouse (p.c. '46).

Inyo County: **1**, Soda-bearing alunite has been analyzed from a deposit in the Funeral Range, Wherry (1) p. 83. **2**, A specimen, S.M.B. (20833) comes from the Cactus Range, W. W. Bradley (26) p. 85.

Kern County: **1**, In rather abundant stringers of coarsely crystalline material, collected by J. W. Bradley (p.c. '45) at Middle Buttes, near Mojave.

Mariposa County: **1**, Constituent of a quartzite at Tres Cerritos, southwest of Indian Gulch, Turner (19) p. 424.

Mono County: **1**, Massive pink and brown alunite occurs with andalusite at the great andalusite deposit in the White Mountains, 7 miles east of Mocalno, Kerr (3) p. 629. An analysis by A. Rautenberg, D. M. Lemmon (p.c. '36) shows that the flesh-colored material is natroalunite.

Orange County: **1**, As chalky nodular masses associated with gypsum in schist, exposed in a road cut at San Juan Capistrano Point, Woodford (p.c. '36).

San Bernardino County: **1**, Abundant with krausite and other sulphates in the "sulphur hole," below the old borax mines, Calico Hills, Foshag (19) p. 352. **2**, Minor greenish-yellow crusts occur on limestone in a barite deposit southwest of Lead Mountain (T. 10 N., R. 1 W., S. B.), Murdoch (p.c. '45).

Shasta County: **1**, Common in the muds of the hot springs south of Lassen Peak as isolated crystals and aggregates, A. L. Day and Allen (1) p. 120, C. A. Anderson (8) p. 242.

Sonoma County: **1**, Common at The Geysers, Vonsen (6) p. 290. **2**, Abundant in Hooker Canyon (E½ sec. 1, T. 6 N., R. 6 W., M. D.), in a breccia, and filling seams up to several feet in width, Laizure (9) p. 56.

ALUNOGEN

Hydrous aluminum sulphate, $Al_2(SO_4)_3 \cdot 16H_2O$

Monoclinic. Fibrous masses, crusts, powder. Vitreous to silky luster. Color white. H. = 1½-2. G. = 1.6-1.8.

In a closed tube gives water. Soluble in water and has an alum taste. Ammonia precipitates aluminum hydroxide.

Alameda County: **1,** Occurred as white powder at Alma mine, Leona Heights, Schaller (1) p. 216.

Inyo County: **1,** Occurs in fibrous masses with epsomite in clay at the mine of the American Magnesium Company near Ballarat, Hewett et al. (1) p. 96.

Marin County: **1,** Fibrous tufts found with gypsum in shale at the road tunnel near Fort Barry, Vonsen (p.c. '32).

Mariposa County: **1,** As fibrous masses with graphite on quartzite at the P and L mine, 2½ miles south of El Portal, W. W. Bradley (28) p. 343.

Nevada County: **1,** Colored blue by copper, it occurs in the Providence mine, Nevada City, Lindgren (12) p. 120.

Placer County: **1,** At the Kilaga mine, 3 miles east of Lincoln, W. W. Bradley (29) p. 107.

San Luis Obispo County: **1,** As a white powder near Paso Robles, Schrader et al. (1) p. 42.

Shasta County: **1,** Incrustations of alunogen appear around the hot springs in the Mount Lassen area, A. L. Day and Allen (1) p. 118.

Sonoma County: **1,** Present in abundance at The Geysers, near Cloverdale, A. L. Day and Allen (2) p. 45, Vonsen (6) p. 290.

ALURGITE

See muscovite

AMALGAM

See gold amalgam

AMARANTITE

Hydrous iron sulfate, $Fe_2O_3 \cdot 2SO_3 \cdot 7H_2O$

Triclinic. Crystals slender prismatic. Usually columnar or bladed aggregates, sometimes radiated. Cleavage perfect, pinacoidal. Brittle. H. = 2.5. G. = 2.11. Color orange to brownish red, streak lemon yellow.

Riverside County: **1,** Amarantite occurs with magnesian copiapite in the Santa Maria Mountains near Blythe, E. S. Dana (6) p. 612, Schairer and Lawson (1), p. 242.

AMAZONITE

See feldspar, microcline

AMARGOSITE

See montmorillonite

AMAZONSTONE

See feldspar, microcline

AMBER

An oxygenated hydrocarbon

In irregular masses, with conchoidal fracture. Transparent to translucent. Luster resinous. Color yellow, sometimes reddish or brownish. H. = 2-2½. G. = 1.096.

Easily fusible.

Ventura County: **1**, The occurrence of amber in minor amounts in Eocene beds on the northeast side of Simi Valley has been described by Murdoch (1) p. 309.

AMBLYGONITE

Lithium-aluminum fluo-phosphate, $LiAl(F,OH)PO_4$

Triclinic. Crystals large and coarse. Generally massive. Cleavage perfect basal. Brittle. Vitreous to pearly luster. Color white to pale bluish. Streak white. H. = 6. G. = 3.01-3.09.

Easily fusible, giving the red flame of lithium. Fused with sodium carbonate and then boiled with nitric acid, the phosphate reaction is obtained on the addition of the solution to ammonium molybdate. Soluble in sulphuric acid.

Amblygonite is an important lithia mineral, but only a few deposits are known in the state.

Riverside County: **1**, At the Fano mine (sec. 33, T. 6 S., R. 2 E., S. B.), on the north side of Coahuila Mountain in a pegmatite with kunzite, tourmaline, and lepidolite, Kunz (24) p. 122, (25) p. 968.

San Bernardino County: **1**, White, massive amblygonite has been found on Turtle Mountain, W. W. Bradley, (26) p. 106.

San Diego County: **1**, A large mass of white massive amblygonite occurred at the Stuart mine, Pala, in a pegmatite carrying rubellite and lepidolite, Kunz (18) p. 259, (24) p. 125, Schaller (8) p. 122. **2**, It occurs also in the Caterina mine and others near Pala, Kunz (24) p. 86. **3**, On Aguanga Mountain, at the Mountain Lily mine, it is associated with cassiterite and blue tourmaline, S. M. B. (18625). **4**, Some white cleavable fragments were found at the Victor mine at Rincon, A. F. Rogers (4) p. 217. **5**, Kunz (24) p. 135, reported it from the Himalaya mine at Mesa Grande. **6**, It occurs with lepidolite at the Royal mine, on the northeast slope of Granite Peak, (probably NW$\frac{1}{4}$ sec. 18, T. 13 S., R. 5 E., S. B.), Kunz (23) p. 314. Further reference for the Pala district, Jahns and Wright (5) pp. 19, 40.

AMETHYST

See quartz

AMIANTHUS

See serpentine

AMMONIA ALUM

See tschermigite

AMPHIBOLES

In this group are a series of complex silicates of magnesium, iron, calcium, and aluminum, or varying combinations of these elements. They are very common rock-forming minerals, and are found in both igneous and metamorphic rocks. They are so common that only the most interesting occurrences can be mentioned.

The following is a common classification of the amphiboles giving species (S) and varietal (V) names:

Anthophyllite (S)
Grünerite (S)
Cummingtonite (S)
Tremolite (S)
  Nephrite (in part) (V)
Actinolite (S)
  Nephrite (in part) (V)

Hornblende (S)
  Edenite (V)
  Pargasite (V)
  Common hornblende (V)
  Basaltic hornblende (V)
Soda amphiboles
  Arfvedsonite (V)
    Barkevikite (V)
  Glaucophane (V)
    Crossite (V)
    Gastaldite (V)
  Riebeckite (V)
    Crocidolite (V)

ACTINOLITE

Basic silicate of calcium, magnesium, and iron, $Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$

Very abundant in the schists of the Coast Ranges and of the Sierra Nevada. Generally in bright-green prisms or prismatic aggregates. G. = 3-3.2.

Alameda and Contra Costa Counties: **1**, Actinolite schists are common in the district around Berkeley and San Pablo. Boulders have been found with radiating crystals up to 10 centimeters in length, Hanks (12) p. 69, Blasdale (1) pp. 328, 333.

Kern County: **1**, Actinolite schists are common in the Rand formation, Hulin (1) p. 24. **2**, Crystals have been found in a contact deposit a quarter of a mile east of Hobo Hot Springs, W. D. O'Guinn, (p.c. '35), associated with molybdenite and garnet.

Madera County: **1**, Coarsely crystalline actinolite occurs in a contact deposit with epidote and garnet on Shadow and Johnston Creeks, at the Iron Mountain magnetite deposit, in the Ritter Range, Erwin (1) p. 67.

Marin County: **1**, Actinolite occurs with lawsonite in the schists half a mile east of Reed Station, F. L. Ransome (3) p. 311, and **2**, in large nests of crystals in talcose rocks east of Sausalito Harbor, J. D. Dana (2) p. 634.

Mendocino County: **1**, Large and beautiful prisms of actinolite were found in a road cut on the Cloverdale Highway, 3 miles northwest of Pieta Creek, Vonsen (p.c. '45). **2**, Large masses of good actinolite prisms occur near Potter Valley (N. R.).

San Benito County: **1**, Actinolite is one of the vein minerals at the benitoite locality, near the headwaters of San Benito River, Louderback and Blasdale (6) p. 360.

San Bernardino County: **1**, Actinolite has been found in the Hillis marble quarry 17 miles east of Victorville, The Mineralogist (3) p. 20. **2**, It is found in the gravels at Cajon Pass, as pebbles of actinolite schist, Webb (p.c. '45).

Siskiyou County: **1**, Massive bladed actinolite occurs near the mouth of Black Gulch on the South Fork, Salmon River, Goudey (p.c. '36).

ANTHOPHYLLITE

Basic silicate of magnesium and iron, $(Mg,Fe)_7Si_8O_{22}(OH)_2$

Orthorhombic. Prismatic. Commonly lamellar or fibrous massive. Cleavage perfect prismatic. Vitreous luster. Color brownish gray, brownish green. Streak uncolored or grayish. H. = 5½-6. G. = 2.85-3.2.

B.B. fuses to a black magnetic enamel. Insoluble in acids.

Anthophyllite is a metamorphic mineral that occurs in schists and gneisses.

Contra Costa County: **1**, Fibrous masses of anthophyllite occur in the schists near San Pablo, and the mineral has been analyzed by Blasdale (1) p. 343.

Riverside County: **1**, It occurs with tremolite and actinolite in the Eagle Mountains, (N. R.).

San Bernardino County: **1**, It occurs in the Slate Range, Hanks (12), p. 67.

Shasta County: **1**, The mineral at the Stock Asbestos mine, 3 miles east of Sims Station, is apparently anthophyllite asbestos, E. Sampson (2) p. 317.

Trinity County: **1**, At Coffee Creek, 1 mile north of Carrville, dark, soda-rich anthophyllite occurs as cross-fiber asbestos veins up to 5 centimeters in width in serpentine, Laudermilk and Woodford (1) p. 259.

CUMMINGTONITE

Basic silicate of magnesium and iron, $(Mg,Fe)_7Si_8O_{22}(OH)_2$

Occurs in brown fibrous or lamellar masses, and is similar to anthophyllite. G. = 3.1-3.4.

San Bernardino County: **1**, Cummingtonite has been reported from Daggett, S. M. B. (11381).

HORNBLENDE

Edenite, Pargasite, Common Hornblende, Basaltic Hornblende
$Ca_4Na_2(Mg,Fe'')_8(Al,Fe''',Ti)_6Si_{12}O_{44}(O,OH)_4$

Variable in composition and rather rich in aluminum. Usually dark green to black.

Hornblende is an extremely common constituent of igneous rocks, gneisses, and schists. In only a relatively few places does it occur in a fashion of any particular interest.

Calaveras County: **1**, Coarsely crystalline rock, made up almost exclusively of hornblende, has been found in considerable volume at Carson Hill, Moss (1) p. 1011. **2**, A large mass of hornblende rock occurs just west of Vallecito on the road to Angels Camp, Wilke (p.c. '36).

El Dorado County: **1**, Large cleavage masses of black hornblende occur with orthoclase, sulphides, and axinite at the old Cosumnes copper mine near Fairplay, (N. R.).

Fresno County: **1**, Pargasite in fine light-brown prisms, occurs in crystalline limestone with spinel and diaspore, Chesterman (p.c. '51).

Mono County: **1**, Long, slender crystals of hornblende have been found with tridymite in cavities of lava 8 miles west of Bridgeport, Schaller (8) p. 128.

Plumas County: **1**, The variety *edenite* is one of the constituents of the plumasite at Spanish Peak, Lawson (5) p. 225.

Riverside County: **1**, Good, dark-green crystals of hornblende up to 1 inch in length were found in a pegmatite just west of the Jensen quarry, 4 miles west of Riverside, J. W. Clark (p.c. '36).

San Bernardino County: **1**, Poorly formed crystals of basaltic hornblende are found in the volcanic ash deposits at Siberia Crater, near Amboy. Occasionally these hornblendes form the cores of small volcanic bombs, Brady and Webb (1) p. 406.

Siskiyou County: **1**, Hornblende occurs as prominent black crystals in andesite at Sugar Loaf, Diller et al. (15) p. 61.

Tulare County: **1**, C. Durrell (p. c. '35) reports hornblende crystals up to several inches in length, in a hornblende gabbro near Woodlake (sec. 9, T. 17 S., R. 26 E., M. D.), and **2**, crystals up to 10 inches in Yokohl Valley (NW¼ sec. 17, T. 18 S., R. 28 E., M. D.).

NEPHRITE

The variety nephrite is tremolite or actinolite in compactly fibrous form, very similar in appearance to jadeite.

Marin County: **1**, Veins and lenses of nephrite have been found in massive serpentine at Massa Hill, sec. 19, T. 5 N., R. 7 W., M. D., Chesterman (3) p. 3, (4) p. 1517.

Mendocino County: **1**, Nephrite occurs in boulders at Williams Creek, about 6 miles east of Covelo, Chesterman (p.c. '51). **2**, Nephrite with crocidolite and jadeite has been reported from boulders in the stream bed, on the north fork, Eel River, near Mina, Anon. (12) p. 2.

Monterey County: **1**, Nephrite of good jade quality has been found in serpentine in the western Santa Lucia Range, between Point Sur and Salmon Creek Ranger Station, mostly as rolled pebbles and boulders, A. F. Rogers (47) p. 1941. **2**, Beach boulders and nodules of nephrite in mylonite occur at Plaskett and Willow Creeks, sec. 19, 31, T. 23 S., R. 5 E., M.D., Crippen (2) pp. 1-14.

Santa Barbara County: **1**, A boulder of nephrite was found near Los Olivos in a creek bed, on the south slope of Figueroa Mountain, C. D. Woodhouse, (p.c. '51).

Siskiyou County: **1**, Nephrite was found at Chan Jade Mine, Indian Creek, near Happy Camp, some with flecks of gold, Kraft (1), p. 34, 35. S.M.B. 21119 from this locality, misidentified in 1943 as California jade, is nephrite of good quality, containing flecks of gold, Crippen (p.c. '55).

Trinity County: **1**, Stream boulders of jadeite with nephrite are reported from the north fork of the Eel River, Anon. (8), p. 16.

Tulare County: **1**, Masses of nephrite, some of cutting quality occur in serpentine at Lewis Hill, 2 miles north of Porterville, Anon. (11) p. 1; Anon. (12), p. 2. Crippen (2) p. 4.

TREMOLITE

Basic silicate of calcium and magnesium, $Ca_2Mg_5Si_8O_{22}(OH)_2$

Common as a metamorphic mineral in schists and crystalline limestones, occurring as white or gray long prismatic and fibrous aggregates, often as asbestos. G. = 2.9-3.2.

Mountain leather and *mountain cork* are flexible sheets of interlaced fibers of tremolite.

Amador County: **1**, Fibrous sheets of tremolite in the form of mountain leather and mountain cork have been found at the Little Grass Valley mine, Pine Grove district, Hanks (12) p. 70.

Contra Costa County: **1**, Tremolite is abundant, with actinolite, in the schists near San Pablo, Blasdale (1) p. 333.

Fresno County: **1**, One- to two-inch crystals have been found in contact zones in crystalline limestones in the Twin Lakes district, Chesterman (1) p. 254.

Inyo County: **1**, Occurs in altered carbonate rocks in the Quartz Spring area, McAllister (3) p. 36.

Kern County: **1**, Large columnar, brittle tremolite occurs at Tollgate Canyon, north of Tehachapi, (N. R.).

Madera County: **1,** White fibrous asbestos is found in piedmontite schist near Shadow Lake, A. M. Short (1) p. 493. **2,** An extensive area of asbestos occurs at the Savannah mine, near Grub Gulch, Bradley and McLaughlin (3) p. 538. and **3,** another at the Baker mine near Coarse Gold (N. R.).

Marin County: **1,** Found with wollastonite in the schists on the shore of Tomales Bay, F. M. Anderson (1) p. 132.

Placer County: **1,** White "slip-fiber" asbestos up to 8 inches was found a quarter of a mile east of Iowa Hill (sec. 28, T. 15 N., R. 10 E., M. D.) (N. R.). **2,** In long gray-green, silky fibres at the Morgan mine south of Towle (sec. 12, T. 15 N., R. 10 E., M. D.), C. A. Waring (4) p. 321; **3,** Large masses of asbestos are reported at Wisconsin Hill and Arizona Flat, (N. R.).

Plumas County: **1,** Asbestos is found on the west slope of Fales Hill, (sec. 25 ?, T. 25 N., R. 7 E., M. D.) Logan (20) p. 85; **2,** At the Fireproof asbestos mine, near Sloat (N. R.). **3,** Tremolite occurs at Rich Bar, Indian Creek, northwest of Meadow Valley, E. S. Dana (5) p. 1096.

Riverside County: **1,** Slip-fiber asbestos has been reported southwest of Palm Springs, a quarter of a mile southwest of Benchmark 3871, secs. 4, 5, T. 7 S., R. 6 E., S. B., southwest of Pinon Flat, F. J. H. Merrill (2) p. 550. **2,** Small amounts of white asbestiform tremolite occur in the crystalline limestone at the Jensen quarry, 4 miles west of Riverside, E. H. Peebles (p.c. '45). **3,** Prismatic aggregates of tremolite occur in the contact limestone at the new city quarry, Riverside, Richmond (1) p. 725. **4,** Well-formed small crystals occur in limestone, with phlogopite, etc., at the Midland mine of the U. S. Gypsum Company, in the Little Maria Mountains, Campbell (p.c. '36). **5,** Mountain cork is reported in whitish, corklike masses from Blythe, Anon. (5) p. 496. **6,** Amphibole asbestos in fibers sometimes over a foot in length, is found in an extensive zone 1½ miles due east of Toro Peak, sec. 31, T. 7 S., R. 6 E., S. B., Durrell (p.c. '54).

San Bernardino County: **1,** It occurs as residual grains in a large talc deposit 7 miles northeast of Silver Lake, Wicks (1) p. 319. **2,** Crystals up to several inches in length occur in the Furnace limestone, Furnace Canyon, Baker (1) p. 337, Woodford and Harriss (4) p. 268. **3,** A pale blue soda-tremolite occurs with diopside near the mouth of Cascade Canyon, Merriam and Laudermilk (1) p. 716. **4,** Coarse-fibered tremolite occurs at the Scorpion mine, 2½ miles from the Mojave River and 14 miles north from Oro Grande, Crossman (2) p. 236. **5,** Gold-bearing tremolite was found in the Wild Rose group, 30 miles southeast of Victorville, Turner (31) p. 835.

San Diego County: **1,** Asbestos fibers up to 6 inches in length come from 3 miles east of Warner Hot Springs, Goodyear (5) p. 148.

Santa Cruz County: **1,** Mountain leather is reported from near Santa Cruz, Fitch (1) p. 9.

Sierra County: **1,** Fibers 5 to 6 inches long come from Goodyear Creek, half a mile from Goodyear Bar, Crawford (1) p. 406. **2,** Long slip-fiber asbestos occurs at the Green and Fair prospect (sec. 33, T. 20 N., R. 12 E., M. D.), Logan (13) p. 154. **3,** Leathery asbestos came from the Plumbago mine, Alleghany district, Ferguson and Gannett (6) p. 48.

Sonoma County: **1**, Lenticular masses of slender prisms occur in the Culver-Baer area, Kramm (1) p. 344.

Trinity County: **1**, Asbestos occurs at several localities—near Castella, Trinity Center and Weaverville, G. C. Brown (2) pp. 876, 877.

Tulare County: **1**, Small occurrences of asbestos are found near Porterville, Frazier Valley, etc., Tucker (3) p. 905.

Tuolumne County: **1**, White fibrous tremolite occurs in the marble near Columbia, Hanks (12) p. 70.

Yuba County: **1**, Small amounts of slip-fiber asbestos occur south of Challenge, and in T. 19 and 20 N., R. 7 and 8 E., M. D., C. A. Waring (4) pp. 423, 424.

SODA AMPHIBOLES

Barkevikite

A hornblende rich in ferrous iron and alkalies.

Fresno County: **1**, Barkevikite occurs near the head of White Creek, (SE¼ sec. 4, T. 19 S., R. 13 E., M. D.) northwest of Coalinga, as crystals in cavities of a soda-syenite, accompanied by analcime, albite and aegirite, Arnold and Anderson (8) p. 158.

Los Angeles County: **1**, Abundant barkevikite occurs in small dikes along South Riverside Drive at the north end of Griffith Park, Neuerburg (p.c. '50).

San Benito County: **1**, A mass of barkevikite syenite occurs near the gem mine, sec. 25, 26, T. 18 S., R. 12 E., M. D., Eckel and Meyers (2) p. 91.

CROSSITE

Intermediate between glaucophane and riebeckite

Contra Costa County: **1**, Crossite was found in a boulder north of Berkeley, and described by Palache (3) p. 185, as a new amphibole. Analysis by Blasdale, Washington (1) pp. 49, 50.

Los Angeles County: **1**, Crossite was discovered as microscopic crystals in schist, in the San Pedro Hills near Malaga Cove, Woodford (1) p. 54, **2**, and from Santa Catalina Island, ibid.

Mendocino County: **1**, Prismatic grains of crossite occur in the Franciscan schist near the headwaters of Jumpoff Creek, near Covelo, S. G. Clark (p.c. '35).

San Diego County: **1**, Crossite occurs in schist boulders of the San Onofre breccia, with glaucophane, Woodford (2) p. 186, Reed (5) p. 347.

GLAUCOPHANE

$Na_4Mg_6Al_4Si_{16}O_{44}(OH,F)_4$

Glaucophane is a widespread constituent of the schists in the Coast Ranges, from Mendocino County to San Diego County.

Alameda County: **1**, General study of glaucophane bearing schists of Berkeley Hills. Brothers (1), p. 614.

Calaveras County: **1**, A specimen from the Collier mine, 6 miles northeast of Murphys was identified as glaucophane by Michael-Levy, Hanks (12) p. 183; S.M.B. (4259).

Lake County: **1**, Glaucophane was described from Sulphur Lake by Becker (4) p. 102, and **2**, from the Wall Street quicksilver mine, Hanks (12) p. 183. S.M.B. (4720).

Los Angeles County: **1**, Glaucophane was found with crossite at Malaga Cove, near Redondo Beach, Reed (5) p. 347. **2**, At Little Harbor, on Santa Catalina Island, W.S.T. Smith (1) p. 1.

Marin County: **1**, Glaucophane occurs with lawsonite near Reed Station, on the Tiburon Peninsula, F. L. Ransome (3) p. 311. **2**, On Angel Island as extremely fine blue needles, F. L. Ransome (2) p. 206.

San Benito County: **1**, Glaucophane occurs at the benitoite locality, near the headwaters of the San Benito River, Louderback and Blasdale (5) p. 360.

San Diego County: **1**, Glaucophane is found in schist boulders of the San Onofre breccia, with crossite, Woodford (2) p. 186. **2**, Glaucophane *(gastaldite)* occurs as silky fibers in diorite at the contact of a pegmatite dike at Rincon (secs. 25, 36, T. 10 S., R. 1 W., S. B.) Murdoch and Webb (6) p. 353.

Santa Clara County: **1**, Glaucophane occurs in eclogite and schists at the north end of Calaveras Valley, Nutter and Barber (1) p. 742. **2**, In the Oak Hill area, Carey and Miller (1) p. 166. **3**, As seams and segregations in eclogite on Coyote Creek 6 miles north of San Martin, Holway (1) p. 347.

Sonoma County: **1**, Glaucophane is found 2 miles southwest of Healdsburg, Nutter and Barber (1) p. 740. **2**, At Camp Meeker, in crystalline schists, ibid. (1) p. 74. **3**, It occurs with lawsonite near Valley Ford (T. 6 N., R. 10 W., M. D.), and near Petaluma, Vonsen (p.c. '45). **4**, Blue crystals of glaucophane occur with clinozoisite, 2½ miles east of Valley Ford, S.M.B. (21318). Confirms Vonsen (p.c. '45).

RIEBECKITE

Basic silicate of sodium and iron, $Na_6Fe''_6Fe'''_4Si_{16}O_{46}(OH)_2$

Crocidolite is the finely fibrous form ("blue asbestos").

Lake County: **1**, S.M.B. (11464), from near Lakeport is crocidolite.

Mendocino County: **1**, Crocidolite, with nephrite and jadeite, occurs in boulders on the north fork, Eel River, near Mina, Anon. (12), p. 2; Chesterman (p.c. '51).

Santa Clara County: **1**, Crocidolite is reported by A. F. Rogers (7) p. 377, from a locality east of Hamilton.

Sonoma County: **1**, A specimen of crocidolite S.M.B. (19626) is from Pine Flat. **2**, Reibeckite is found with aegirite in cavities of soda rhyolite near Glen Ellen on the east side of Sonoma Valley, Chesterman (p.c. '51).

Tulare County: **1**, Clusters of riebeckite needles as much as a quarter of an inch in length, are found along a serpentine contact, in quartz-albite schist, southeast of Rocky Hill, Durrell (2) p. 93.

Tuolumne County: **1**, Microscopic radiating tufts of riebeckite needles are found in albitite, at the Clio mine half a mile east of Jacksonville, A. Knopf (11) pp. 21, 40.

ANALCITE—Analcime

Hydrous sodium and aluminum silicate, $NaAlSi_2O_6 \cdot H_2O$

Isometric. Crystals usually trapezohedrons. Also massive granular; compact. Brittle. Vitreous luster. Colorless to white. H. = 5-5½. G. = 2.22-2.29.

Fuses to a clear glass and shows bright-yellow flame of sodium. Gelatinizes with hydrochloric acid. Gives a small amount of water in a closed tube.

Analcime is a zeolite occurring as a secondary mineral in volcanic rocks and often in large, well-formed crystals. It is also found as an original constituent in some diabases and basalts.

Alameda County: **1**, Occurs in brilliant crystals, and massive, in amygdules of andesite in the Berkeley Hills, Lawson and Palache (4) p. 418.

Fresno County: **1**, Found with albite, aegirite, and barkevikite in cavities in a soda-syenite near the head of White Creek (SE$\frac{1}{4}$ sec. 4, T. 19 S., R. 13 E., M. D.), Arnold and Anderson (8) p. 158; it appears that this may be the occurrence referred to under San Benito County as White Creek.

Inyo County: **1**, Occurs as crystals in amygdules of a basalt near the Russell borax mine, Mt. Blanco district, associated with radiating natrolite, Foshag (10) p. 10.

Kern County: **1**, The lava flows of Red Rock Canyon carry associated analcime, natrolite, calcite, and occasionally opal, in the amygdules, Murdoch and Webb (14) p. 330.

Los Angeles County: **1**, Crystals up to $\frac{3}{8}$-inches in diameter appear in seams of basalt near Lake Malibu, Schwarz (1) p. 414. **2**, Analcime occurs with natrolite in cavities of ''dolerite'' on Mulholland Drive, Schürmann (1) p. 12. **3**, Analcime, with natrolite, prehnite, and apophyllite, is found in veins and cavity fillings in basalt in the Pacific Electric quarry in Brush Canyon, locality 3, Neuerburg (1) p. 158, **4**, Small crystals occur with natrolite in cavities in lava at the head of Tick Canyon, near Lang, Anon. (20), p. 382.

Mono County: **1**, Small crystals are found in volcanic rock from Leavitt Meadows, W. W. Bradley (32) p. 565.

Plumas County: **1**, Occurs in druses of the pegmatites, and as an accessory mineral in the igneous rocks at the Engels mine, Turner and Rogers (32) p. 373, Graton and McLaughlin (4) p. 18.

San Benito County: **1**, Crystals of analcime occur in seams of barkevikite syenite on White Creek (San Benito River?), sec. 25, 26, T. 18 S., R. 12 E., M.D., Watters (p.c. '51) (See Fresno County, 1).

San Mateo County: **1**, Occurs as glassy crystals in amygdules of basaltic rock at Langley Hill, Haehl and Arnold (1) p. 39.

San Luis Obispo County: **1**, Occurs in cavities in augite-teschinite dikes on the north side of the Cuyama Valley and also as water-clear grains up to 6 millimeters disseminated through the rock, Fairbanks (12) p. 277.

Santa Barbara County: **1**, Occurs in large grains, and as inclusions in augite grains, in an augite-teschinite rock at Point Sal, Fairbanks (14) p. 21.

Shasta County: **1**, Occurs with chabazite, natrolite, and tridymite in an amygdaloidal basalt 7 miles east of Round Mountain, Melhase (3) No. 6, p. 1.

Trinity County: **1**, Reported in crystals more than 1$\frac{1}{2}$ inches in diameter from a placer mine in this county, Bixby (2) p. 168.

Ventura County: **1**, Found with natrolite in amygdules of basalt in the Frazier Mountain borax district, H. S. Gale (11) p. 439.

ANAPAITE

Hydrous calcium and iron phosphate, $(CaFe)_3(PO_4)_2 \cdot 4H_2O$

Triclinic. Usually in tabular crystals. Two cleavages. Vitreous. Color pale green. H. = 3$\frac{1}{2}$. G. = 2.8.

Soluble in nitric acid; a yellow precipitate is obtained by adding the acid solution to ammonium molybdate. Anapaite becomes magnetic on heating. Gives water in a closed tube.

Kings County: **1**, Layers of pale green crystals were found at a depth of 500 feet in core from the Lewis well (sec. 23, T. 21 S., R. 21 E., M.D.), Melhase (3) No. 7, p. 7.

ANATASE—Octahedrite

Titanium dioxide, TiO_2

Tetragonal. Small pyramidal crystals. Cleavage perfect basal and pyramidal. Brittle. Adamantine to metallic luster. Color brown. Streak uncolored. H. = 5½-6. G. = 3.82-3.95.

Same reactions as rutile.

This form of titanium oxide is rarer than rutile, and is found only in minute crystals.

El Dorado County: **1**, Minute crystals with brookite were found on quartz crystals near Placerville, Kunz (5) p. 329, (6) p. 395, (7) p. 207, (15) p. 394.

Nevada County: **1**, Crystals of anatase have been reported in placer gravels near North Bloomfield, Crippen (p.c. '51).

Riverside County: **1**, Anatase occurs as a minor constituent of tonalite, in the tunnel south of Val Verde, R. W. Wilson (1) p. 124.

San Benito County: **1**, A few minute pale-brown crystals were found in the benitoite vein, Palache (6) p. 398, Louderback and Blasdale (5) p. 380.

San Bernardino County: **1**, Niobian anatase, in numerous flat tetragonal crystals, occurs in masses of soft greenish mica in a pegmatite in the Cady Mountains, north of Hector, Hewett & Glass, (3) p. 1044.

ANAUXITE

Hydrous aluminum silicate, $Al_8(Si_3O_{10})_3(OH)_{12}\cdot 3H_2O$

Monoclinic. In crystal plates with hexagonal outline. Perfect basal cleavage. Luster pearly. Color white or pale brown. H. = 2½. G. = 2.524.

Alameda County: **1**, A constituent of the sedimentary rocks near Tesla (secs. 11, 12, T. 3 S., R. 3 E., M. D.), V. T. Allen (5) p. 274.

Amador County: **1**, A characteristic constituent of the Ione sandstone, especially on the Mokelumne River, 1 mile west of Lancha Plana, V. T. Allen (2) p. 145. **2**, Material from the Newman pit near Ione was analyzed by Fairchild, R. C. Wells (3) p. 97.

Contra Costa County: **1**, Some sedimentary layers in the Brentwood area, east of Mount Diablo (T. 1 N., R. 2 and 3 E., M. D.) carry up to 60 percent anauxite, V. T. Allen (5) p. 280.

Fresno County: **1**, Occurs in occasional layers of the sediments in the Panoche Hills, V. T. Allen (5) p. 277.

Plumas County: **1**, Identified by A. F. Rogers (38) p. 160 as minute, pale-brown, thin tabular crystals in cavities of a pyroxene andesite.

Tuolumne County: **1**, Thin brown crystals occur in cavities of an augite andesite, near Jamestown, A. F. Rogers (36) p. 160.

ANDALUSITE

Aluminum silicate, Al_2SiO_5

Orthorhombic. In coarse prismatic forms. Massive, columnar. Cleavage prismatic distinct. Brittle. Vitreous luster. Colorless, gray, pink, rose red, violet, green. Streak uncolored. H. = 7½. G. = 3.16-3.20.

Infusible. Moistened with cobalt nitrate and heated, yields the alumina blue color. Insoluble.

Chiastolite is andalusite with symmetrically arranged black inclusions.

Andalusite occurs as a constituent of gneisses and schists, and is usually associated with kyanite, sillimanite, and staurolite.

Alpine County: **1,** Found in some abundance, with lazulite, ilmenite, and rutile, in metamorphic rocks about 10 miles south-southwest from Markleeville, Woodhouse (p.c. '45).

Butte County: **1,** Andalusite crystals as much as 2 cm in size occur in andalusite schists, 1½ miles southeast of Big Bear Lookout (locality 415), Hietanen (1) p. 575.

Fresno County: **1,** Large crystals were found in pegmatite in Clarks Valley 9 miles east of Sanger, Melhase (6) p. 22. **2,** Radiating masses and prismatic crystals up to 10 by 15 centimeters, of a pink to dark-reddish-violet color, were found in a narrow pegmatite about 1½ miles southeast of Sharpsville (S½ sec. 20, T. 11 S., R. 22 E., M. D.), Macdonald and Merriam (1) p. 588.

Kern County: **1,** Chiastolite schists occur on Walker Creek southeast of Bakersfield, Sampson and Tucker (4) p. 453.

Los Angeles County: **1,** The "spotted" (cordierite) slates at the junction of Franklin and Coldwater Canyons, Santa Monica Mountains, carry fair-sized chiastolite crystals, Funk (1) p. 33. **2,** Chiastolite crystals are prominent in the Santa Monica "slate" at localities 14, 15, 16, 17, in Nichols, Coldwater, and Franklin Canyons, Neuerburg (1) p. 159.

Madera County: **1,** Chiastolite was first noted by W. P. Blake (7) p. 304, along the Chowchilla River, notably at Chowchilla crossing on the old Fort Miller road, Hanks (12) p. 70. **2,** Crystals of andalusite up to 1 centimeter in length, in a muscovite matrix, were found half a mile below the junction of Bench Creek and the North Fork, San Joaquin River, Erwin (1) p. 29. **3,** Large crystals (3 inches by ½ inch) were found at the Ne Plus Ultra mine, near Daulton's Ranch (sec. 35, T. 9 S., R. 18 E., M. D.), Hanks (12) p. 70, Turner (4) p. 455, Logan (24) p. 42. **4,** Fine specimens, in size up to 3 by 1¼ inches showing a rich black cross pattern on white or salmon-colored background were described by W. W. Jefferis from this county, but the exact locality is not known, Kunz (24) pp. 88-89.

Mariposa County: **1,** Small crystals in slate are found at Miller's Ranch near Hornitos, Hanks (12) p. 70. **2,** Chiastolite is found on Moores Flat, ibid. p. 70.

Mono County: **1,** A large commercial deposit of andalusite, which carries corundum, pyrophyllite, and many other minerals in small amounts, is worked at the mine of Champion Sillimanite Incorporated, on the western slope of the White Mountains about 7 miles east of Mocalno, A. Knopf (7) p. 550, Peck (1) p. 123, Jeffery and Woodhouse (3) p. 461, Kerr (3) p. 621, Woodhouse (5) p. 486. **2,** Andalusite occurs with lazulite, etc., in metamorphic rocks 1 mile west of Green Lake (sec. 28?, T. 3 N., R. 24 E., M. D.), Woodhouse (p.c. '45).

Nevada County: **1,** It has been reported from Grass Valley by Lindgren (12) p. 92.

Riverside County: **1,** Opaque pink andalusite occurs near Coahuila, Kunz (24) p. 99. **2,** Pink crystals in a small pegmatite cutting the magnesite deposit near Winchester have been described by Murdoch (3) p. 68. **3,** Giant pink crystals occur in pegmatite on Coahuila Mountain (sec. 29, T. 6 S., R. 2 E., S. B.), and **4,** north of Winchester (sec. 12, T. 5 S., R. 2 E., S. B.) Webb, (11) p. 581.

San Diego County: **1,** Pink radiating masses in a quartz vein are found about 3 miles northeast of Pala (sec. 12, T. 9 S., R. 2 W., S. B.), Schaller (p.c. '46). **2,** Masses of andalusite as much as 3 inches in diameter are found in the northern parts of the Queen and Chief mines at Pala, Jahns and Wright (5) p. 42.

Tulare County: **1,** Crystals up to 5 centimeters long were found on the west side of the valley of Sheep Creek (NW$\frac{1}{4}$ sec. 34, T. 11 S., R. 28 E., M. D.), Durrell (p.c. '35).

ANDESINE

See feldspar

ANDRADITE

See garnet

ANGLESITE

Lead sulphate, $PbSO_4$

Orthorhombic. Prismatic and tabular crystals; massive, granular to compact. Brittle. Adamantine luster. Color white, yellow, gray, green. Streak uncolored. H. = $2\frac{1}{2}$-3. G. = 6.3-6.39.

Easily fusible. Can be reduced on charcoal with soda to metallic lead. Slightly soluble in nitric acid.

Anglesite is a common oxidation product of galena, and is often found in lead districts in small amounts.

Inyo County: **1,** At the Modoc mine, anglesite is associated with bindheimite and azurite, as an oxidation product of galena, Hanks (12) p. 71. **2,** In the mines of the Cerro Gordo district it occurred as large masses and crystalline crusts enclosing cores of galena, Silliman (12) p. 131; R. W. Raymond (5) p. 30. **3,** In the Ubehebe district it occurs with cerussite as alteration from galena, C. A. Waring and Huguenin' (2) p. 109. **4,** Sparingly present in the Darwin mines, A. Knopf (4) p. 7. **5,** In the Panamint district, Murphy (2) p. 322. **6,** Abundant as an ore mineral in the Minietta and Modoc districts, Argus Range. Woodhouse (p.c. '54).

Madera County: **1,** Reported as alteration of galena in the Minaret district on Shadow Creek, and with linarite in the Bliss claims, North Fork Basin, Erwin (1) pp. 67, 70.

Mono County: **1,** Widely distributed in moderate quantity in the Blind Spring Hill area, A. L. Ransome (2) p. 192. Crystals a third of an inch in diameter were reported from this area by Hoffman (1) p. 732.

Plumas County: **1,** With wulfenite in gold ores from the Granite Basin district, Turner (12) p. 589.

Riverside County: **1,** A very small amount of anglesite has been found at the Crestmore quarry, Eakle (15) p. 353. **2,** It occurs with carbonates and vanadates, at the Black Eagle mine, in northern part of the Eagle Mountains, Tucker (8) p. 195.

San Bernardino County: **1,** Anglesite, massive and in crystals occurs at the Ibex mine in the Black Mountains 6 miles south of Saratoga Springs, Cloudman, et al. (1) p. 821. **2,** It occurs in small amounts in the West Calico district, Weeks (2) p. 762. **3,** In the Imperial lode, Lava Beds district, with wulfenite, Tucker and Sampson (17) p. 351.

ANHYDRITE

Anhydrous calcium sulphate, $CaSO_4$

Orthorhombic. Crystals thick tabular, also prismatic. Usually massive, lamellar, granular. Three perfect rectangular cleavages. Brittle. Luster vitreous to pearly. Color white, sometimes with a grayish, bluish, or reddish tinge; also brick red. Streak grayish-white. H. = 3-3½. G. = 2.89-2.98.

B.B. fuses at 3, coloring the flame reddish yellow, and yielding an enamel-like bead which reacts alkaline. Soluble in hydrochloric acid.

Imperial County: **1,** Anhydrite is reported from the Fish Creek Mountains, Min. Inf. Serv. (22) p. 1.

Inyo County: **1,** Reported from St. Ignacio and Cerro Gordo mines (N. R.). **2,** Found in small amounts in the Panamint and Funeral Ranges, Kunz (24) p. 103.

Mono County: **1,** Anhydrite occurs in the mountains south of Mono Lake, Kunz (24) p. 103.

Orange County: **1,** Anhydrite was found sparingly near Anaheim, probably half a mile south of Santa Ana, Hanks (12) p. 72, Goodyear (3) p. 339.

Riverside County: **1,** Anhydrite occurs interlayered with gypsum in the Palen Mountains, A. F. Rogers (14) p. 134. **2,** Massive white crystalline anhydrite occurs at the Midland mine in the Little Maria Mountains; S.M.B. (20112), Anon. (23) p. 1.

San Bernardino County: **1,** Anhydrite is one of the many minerals found in small amounts at Searles Lake, De Groot (2) p. 537. **2,** It occurs in the Owl Mountains near Owl Springs; **3,** in the Avawatz Mountains near the Amargosa River, Kunz (24) p. 103; **4,** in the "sulphur pit" with krausite and other sulphates near Borate, in the Calico Mountains, Foshag (19) p. 352.

Shasta County: **1,** In the deep levels of the Bully Hill and Rising Star mines, it is found partly altered to gypsum, A. F. Rogers (14) p. 132.

ANKERITE

Carbonate of calcium, magnesium, iron, and manganese, $CaCO_3 \cdot (Mg,Fe,Mn)CO_3$

Hexagonal-rhombohedral. In rhombohedral crystals. Also crystalline massive, granular. Cleavage like calcite. Luster vitreous to pearly. Color white to brown. H. = 3½-4. G. = 2.95-3.1.

B.B. like dolomite, but darkens in color; with the fluxes reacts for iron and manganese. Soluble with effervescence in the acids.

Amador County: **1,** Ankerite occurs as incrustations on slate in the Plymouth mine, A. Knopf (11) p. 35.

Calaveras County: **1,** It is abundant at Carson Hill, A. Knopf (11) p. 35; **2,** occurs at the Golden Gate mine, 1 mile north of San Andreas, Tucker (1) p. 82.

El Dorado County: **1,** It is one of the gangue minerals in gold quartz veins at the Larkin mine, 1 mile east of Diamond Springs, Logan (16) p. 30.

Mariposa County: **1,** It was first reported as an associate of mariposite on the Mariposa Estate, Silliman (7) p. 350. **2,** It occurs in many of the Mother Lode mines in this county. **3,** As an enormous, massive belt of coarse white carbonate 300 to 500 feet wide, just west of Coulterville, A. Knopf (11) p. 35.

Nevada County: **1,** It is abundant in the veins of the mines at Grass Valley, W. D. Johnston, Jr. (4) p. 34.

Plumas County: **1,** Flat crystals, with pyrite and associated with fine albite crystals in vugs, occur at the Shady Run mine, 8 miles east of Dutch Flat, Reid (1) p. 280.

San Bernardino County: **1,** It is found in the scheelite veins, as part of the gangue, in the mines at Atolia, Hulin (1) p. 73.

Tuolumne County: **1,** Ankerite is widespread as a gangue mineral in the Mother Lode mines of this county, Storms (9) p. 131.

ANNABERGITE—Nickel Bloom

Hydrous nickel arsenate, $Ni_3As_2O_8 \cdot 8H_2O$

Monoclinic. In capillary crystals and finely fibrous incrustations. Vitreous luster. Color apple green. H. = 2½-3. G. = 3.

Reacts similarly to erythrite, but the borax bead of nickel is brown in the oxidizing flame, and cloudy gray in the reducing flame.

Coatings of annabergite are an indication of the presence of nickel minerals that have been oxidized, and it is often associated with erythrite.

Inyo County: **1,** It was found associated with erythrite, smaltite, and argentite in the claims of the Bishop Silver and Cobalt Mining Company, just east of Long Lake (sec. 14, T. 9 S., R. 31 E., M. D.), Tucker and Sampson (25) p. 378.

Lassen County: **1,** A specimen, associated with smaltite and erythrite (?), from this county is in the State Mining Bureau Museum (9981), but no detail of locality is available.

Los Angeles County: **1,** It has been found with siderite and pyrrhotite in Pacoima Canyon, D'Arcy (3) p. 269. **2,** It occurs with erythrite, smaltite, and native silver at the old Kelsey mine in San Gabriel Canyon, Storms (4) p. 244.

Tulare County: **1,** Specimens of annabergite have come from near Porterville, Noren (p.c. '54).

ANORTHITE

See feldspar

ANTHOPHYLLITE

See amphibole

ANORTHOCLASE

See feldspar

ANTIMONITE

See stibnite

ANTIMONY

Native antimony, Sb.

Hexagonal-rhombohedral. Generally massive, lamellar. Perfect basal cleavage. Brittle. Metallic luster. Color and streak tin white. H. = 3-3½. G. = 6.7.

B.B. on charcoal fuses very easily, and is wholly volatile giving a white coating. The white coating tinges the R.F. bluish green. Crystallizes readily from fusion.

Native antimony occurs in metal-bearing veins with silver, antimony, and arsenic ores, especially with stibnite.

Native antimony has been found at a few localities in the state. Many references to "antimony" in the literature, are to the sulphide, stibnite, but there are some authentic occurrences.

Butte County: **1**, Native antimony is reported with bournonite in the gold ores of the Surcease mine, T. 21 N., R. 4 E., M.D., O'Brien (6) p. 431.

El Dorado County: **1**, Native antimony has been reported from Pleasant Valley. (N. R.)

Kern County: **1**, Antimony has been found in a number of localities in the Havilah and Kernville areas, associated with stibnite. Notable occurrences are as follows: 1, On Erskine Creek 4 miles south of Hot Springs, nodular masses up to 300 pounds have been found, Watts (2), p. 237. **2**, The Rayo mine (sec. 36, T. 26 S., R. 33 E., M. D.) and **3**, Erskine Creek (Tom Moore) mine (sec. 24, T. 27 S., R. 33 E., M. D.), have furnished specimens associated with stibnite, W. W. Bradley (11) pp. 21, 22, Behre (1) p. 332. **4**, It was found at Little Caliente Spring, south of Piute, with stibiconite; S. M. B. (11671). **5**, It has also been reported from the old San Emigdio mine (N. R.). **6**, From Antimony Peak, 12 miles southwest of Sunset and 5 miles northwest of Cuddy Valley, Tucker (p.c., '36). **7**, In Jawbone Canyon (secs. 5, 6, T. 30 S., R. 36 E., M. D.), (N. R.).

APATITE

Calcium phosphate, with other elements

Fluorapatite, $Ca_5(PO_4)_3F$

Chlorapatite, $Ca_5(PO_4)_3Cl$

Hydroxylapatite, $Ca_5(PO_4)_3(OH)$

Carbonate apatite, $Ca_5(PO_4)_3(CO_3)H_2O$

Hexagonal. Prismatic and tabular crystals. Massive, granular to compact. Brittle. Vitreous to greasy luster. Colorless, green, yellow and brown. Streak white. H. = 4½-5. G. = 3.17-3.23.

Practically infusible, but easily soluble. Ammonium molybdate precipitates much canary-yellow granular powder. Calcium can be determined by dissolving apatite in hydrochloric acid, adding ammonia to precipitate the calcium phosphate, re-dissolving this precipitate with just enough acid, and then adding ammonium oxalate, which will precipitate the calcium as oxalate. Some varieties give a fluorine test, or effervesce, showing CO_2.

Voelckerite, *francolite*, and *fluor-collophane*, are fluorapatite.

Dahllite and most *collophane* are carbonate apatite.

A variety of voelckerite with little fluorine seems to be characteristic of the glaucophane schists in the Coast Ranges.

Collophane is the chief constituent of phosphorite and bone phosphate. Its general occurrence in Pacific coastal waters has been discussed by Emery and Dietz (3) p. 8.

Apatite has been observed as small crystals in many of the rocks of the state.

Amador County: **1**, Apatite was the principal gangue mineral in some of the deep-level ore of the Kennedy mine at Jackson, Hulin (3) p. 348.

Contra Costa County: **1**, The variety *voelckerite* was found in tabular honey-yellow crystals, in a boulder of glaucophane schist just west of the Berkeley Country Club, Coats (p. c., '36).

Fresno County: **1**, Apatite, in crystals up to 1 inch, was reported with andalusite in a pegmatite in Clarks Valley, 9 miles east of Sanger, Melhase (6) p. 22. **2**, Gallilier (1) p. 258 has analyzed impure granular collophane from sediments penetrated by Pacific Western well KOC No. 27.

Humboldt County: **1**, Collophane occurs with dahllite near Yager (Stanford Museum specimen).

Inyo County: **1**, A small amount of apatite has been found in the contact zone in the Darwin district, Kelley (4) p. 540. **2**, Found 9 miles southeast of Keeler, W. W. Bradley (29) p. 106.

Mono County: **1**, Small white tabular crystals are associated with lazulite and pyrophyllite at the andalusite deposit in the White Mountains, Peacock and Moddle (1) p. 105.

Monterey County: **1**, Collophane occurs in beds of phosphate rock in Vaquero Canyon, Reed (3) p. 196. **2**, As concretionary pellets in shale in Reliz Canyon, Galliher (1) p. 266.

Plumas County: **1**, Large crystals, accompanying abundant sphene, occur in the country rock of the Superior mine near Engels, Graton and McLaughlin (4) p. 34. **2**, It is also found at the Engels mine, with magnetite, ibid, p. 11. **3**, White apatite with black tourmaline is reported from Thompson Peak, Williams (p.c. '49).

Riverside County: **1**, Greenish-blue apatite occurred as granular masses in white calcite, at the Crestmore quarry, Eakle (15) p. 348. **2**, A small amount was found in the contact zone at the new city quarry in Riverside, Richmond (1) p. 725. **3**, It occurs in a scapolite-pyroxene dike at the eastern end of the iron-ore belt, in the Eagle Mountains, Harder (6) p. 54.

San Bernardino County: **1**, Small opaque crystals were found in limestone at the eastern end of the Kingston Range, Kunz (24) p. 102. **2**, Apatite is a minor constituent in the bastnaesite occurrence at Mountain Pass, Pray (p.c. '51).

San Diego County: **1**, It was a minor constituent of the dumortierite pegmatite near Dehesa, Schaller (7) p. 211. **2**, Violet and pale-pink tabular crystals occurred at the old Mack mine, and pale dirty green crystals at the Victor mine, both near Rincon, A. F. Rogers (4) p. 217. **3**, Thick tabular yellowish-green crystals, up to 1 centimeter occur in spodumene-petalite rock in the Clark dike, in the same locality, Murdoch (p.c. '45). **4**, Apatite occurs in pegmatite on Smith Mountain, Schrader et al. (1) p. 42. **5**, It occurs at Mesa Grande, sometimes colored red-violet due to the presence of neodymium, Wherry (2) p. 146. **6**, Apatite from the Gem mine No. 1 near Aguanga is in tabular crystals up to 1 inch across, Wilke (p.c. '36), and pure violet in color from the Mountain Lily, Wherry (2) p. 146. **7**, It is found in pegmatite at Dos Cabezas mine near Jacumba, Kunz (24) p. 102. **8**, Near Grapevine Camp (sec. 26, T. 11 S., R. 4 E., S. B.), F. J. H. Merrill (1) p. 717. **9**, It has been reported from the pegmatites of Pala, Kunz (23) p. 942, and tabular crystals, as much as a quarter of an inch in diameter, pink violet, or purple have been found in the Queen mine and on Heriart Mountain at Pala, Jahns and Wright (5) p. 41. **10**, Minute prisms of francolite, pale flesh colored, occur filling fractures in massive amblygonite at the Stewart mine, Pala, Murdoch (p. c. '45). **11**, Francolite is abundant in nodules dredged from the sea bottom off the southern California coast, Dietz and Emery (1) p. 1878, Dietz et al. (2) p. 818.

Santa Barbara County: **1**, Occurs as small concretionary masses in shale near Santa Barbara, Galliher (1) p. 266.

Santa Clara County: **1**, The variety voelckerite occurs as veinlike patches in glaucophane rock in Calaveras Valley, A. F. Rogers (9) p. 160.

Sierra County: **1**, White prismatic crystals up to three-quarters of an inch in length occur in cavities in the magnetite ore of the Sierra iron mine at Upper Spencer Lake, Durrell (p.c. '45).

APHTHITALITE—Glaserite

Sulphate of potassium and sodium, $(K,Na)_2SO_4$

Hexagonal-rhombohedral. Tabular crystals; massive and in crusts. Prismatic cleavage. Brittle. Vitreous luster. Color white. H. = 3. G. = 2.7.

Fuses with yellow flame which shows violet through blue glass. Soluble in water. Barium chloride precipitates barium sulphate.

San Bernardino County: **1**, Colorless tabular crystals, of trigonal aspect, associated with octahedral halite and massive borax, came from well G. 75 at Searles Lake, Foshag (5) p. 367.

APLOME

See garnet

APOPHYLLITE

Hydrous calcium and potassium fluosilicate, $Ca_4K(Si_4O_{10})F_2 \cdot 8H_2O$

Tetragonal. Square prisms, pyramids, massive. Cleavage perfect basal. Brittle. Pearly to vitreous luster. Colorless, white, grayish, pale violet, greenish, yellowish. H. = $4\frac{1}{2}$-5. G. = 2.3-2.4.

Fuses with swelling to white enamel and shows the violet flame of potassium. Gives much water in a closed tube. Soluble in hydrochloric acid, but without gelatinization.

Apophyllite is a secondary mineral found in cavities of volcanic rock.

Los Angeles County: **1**, Thin tabular crystals up to the size of a silver dollar, associated with natrolite, analcime, and prehnite occur as coatings on joints of basalt, in the Pacific Electric quarry, Brush Canyon (sec. 35, T. 1 N., R. 14 W., S. B.), Murdoch (p.c. '45), Neuerburg (1) p. 158.

Marin County: **1**, Clear glassy crystals 1 to 2 millimeters in size occur with wollastonite and calcite in fissures of a quartzite, $1\frac{1}{2}$ miles northwest of Inverness on the west side of Tomales Bay, Vonsen (p.c. '37).

Plumas County: **1**, Crystals of apophyllite occur in cavities in basalt at the Buckeye mine, near Onion Valley, Kunz (24) p. 97.

Riverside County: **1**, Cavities in limestone or in massive wollastonite in the Crestmore quarry are lined with small clear pyramidal crystals of apophyllite, Eakle (15) p. 350, Woodford et al. (1) p. 370. **2**, Skeletal crystals, up to 3 millimeters across have been found in the new city quarry, Riverside, E. H. Bailey (3) p. 565. **3**, Similar skeletonized crystals were also found with prehnite at Crestmore, ibid.

San Francisco County: **1**, Very minute colorless crystals were found with gyrolite at Fort Point, in San Francisco, Schaller (8) p. 126.

San Mateo County: **1**, A little apophyllite was found near La Honda, Sanford and Stone (1) p. 24.

Santa Clara County: **1**, Well-developed crystals, with gyrolite and bituminous matter, were found lining crevices in the rock at the New Almaden mine, Clarke (4) p. 22.

AQUAMARINE

See beryl

ARAGONITE

Calcium carbonate, $CaCO_3$

Orthorhombic. Slender prisms, columnar, fibrous, stalactitic, massive, and coralloidal. Cleavage poor. Brittle. Vitreous luster. Colorless, white, brown, yellow, green. Streak uncolored. H. = 3½-4. G. = 2.93-2.95.

Distinguished from calcite by its action with cobalt nitrate. The powder boiled in a solution of cobalt nitrate turns violet, and the solution also assumes this color, whereas calcite has no effect on the solution. Other reactions the same as for calcite.

Flos-ferri is a fine snow-white branching stalactitic form of aragonite.

Much of the banded onyx marble of the state has been erroneously called aragonite.

Alameda County: **1**, Coarsely crystalline aragonite in radiating prismatic masses occurs in a limestone quarry on the Patterson grade, 7 miles east of Livermore, A. F. Rogers (p.c. '36).

Calaveras County: **1**, Stalactites of flos-ferri have come from a cave near Murphy, S. M. B. (13702). **2**, S. M. B. (13684) is from Coyote Creek, near Vallecitos.

Colusa County: **1**, Rich, deep-brown veins up to 5 inches across, and banded masses, occur at the head of Sulphur Creek, Fairbanks (6) p. 120, Goodyear (4) p. 159. **2**, Beautiful snow-white and transparent crystals have come from the Candace copper mine, Hanks (12) p. 73. **3**, Aragonite has come from Stony Ford, S. M. B. (12796). **4**, It occurs near Smithville, Hanks (12) p. 74.

Fresno County: **1**, Showy clusters of acicular crystals of aragonite have been found coating fracture surfaces of serpentine at the Holman chrome mine, sec. 34, T. 18 S., R. 13 E., M. D., Murdoch (p.c. '54).

Inyo County: **1**, Showy aggregates of crystals have been collected from an abandoned mine in Titus Canyon, W. W. Bradley (24) p. 253. **2**, Aragonite has also been found at the Whiteside mine, Mazourka Canyon (T. 12 S., R. 36 E., M. D.), D'Arcy (2) p. 74. **3**, Aragonite associated with halite has been collected at Bad Water in Death Valley, Vonsen (p.c. '45).

Kern County: **1**, Concretionary crystalline masses occur with gypsum in a bed near the south end of the Kettleman Hills (sec. 10, T. 25 S., R. 10 E., M. D.), Reed (2) p. 830.

Lake County: **1**, Acicular crystals occur with opal in basalt at Sulphur Bank, C. A. Anderson (9) p. 650.

Los Angeles County: **1**, It was found in Silver Canyon, on Santa Catalina Island, S. M. B. (12415). **2**, Rosettes of aragonite prisms occur on fractures in basalt, accompanied by natrolite and analcime. Locality 7, west of Laurel Canyon, Neuerburg (1) p. 151.

Madera County: **1**, Acicular crystals occur in the copper deposit at Beck's Lakes, Goudey (1) p. 7.

Monterey County: **1**, Aragonite specimens from the cliff north of the mouth of Willow Creek are in the Division of Mines Museum, S. M. B. (21307).

Orange County: **1**, A specimen, S. M. B. (12658) comes from Coal Canyon, on the west side of Mount Downey (Sugarloaf Mountain).

Placer County: **1**, It has been doubtfully reported from Gold Run, Hanks (12) p. 73.

Riverside County: **1**, A small amount of fibrous aragonite occurred at Crestmore, Eakle (15) p. 348 and prismatic crystals occur on fracture surfaces of contact rock Commercial quarry. Murdoch (p.c. '54).

San Benito County: 1, Aragonite occurs as bunches and stringers in the country rock of the benitoite vein near the headwaters of the San Benito River, Louderback and Blasdale (5) p. 363.

San Bernardino County: 1, It was reported by Silliman (12) p. 130, as probably near Calico. It is likely that this is really strontianite, which occurs here rather abundantly. 2, Clusters of prismatic crystals have been found in the upper quarries near Oro Grande (T. 6 N., R. 4 W., S. B.), Huguenin et al. (3) p. 878.

San Diego County: 1, A cluster of slender prisms, associated with calcite and stilbite, was found in a cavity of the volcanic rock at the Calavera quarry, Murdoch (p.c. '45).

San Francisco County: 1, Slender colorless prisms of aragonite were found in seams of the serpentine at Fort Point, Eakle (1) p. 316.

Siskiyou County: 1, Aragonite has come from a mineral spring near the Soda Springs Hotel, Hanks (12) p. 73.

Solano County: 1, It was reported at Tolenas Springs, Watts (1) p. 668.

Sonoma County: 1, Needle-like crystals and crusts were found in the Helen mine, Kramm (1) p. 345.

Tehama County: 1, Crystals occur on fracture surfaces of chromite at the Gran pit, on Elder Creek, S. M. B. (21143). 2, S. M. B. (11876) is from Tuscan mineral spring.

Tulare County: 1, From near Tulare, S. M. B. (11643) and 2, Three Rivers, S. M. B. (9907).

Tuolumne County: 1, It is reported from Table Mountain (N. R.),

*ARAGOTITE, 1873

A hydrocarbon

Bright scales. Transparent. Color honey yellow. Streak white. Volatile. H. = 1. G. = 1.1.

This material, no longer recognized by Dana as a mineral species, has been reported from several cinnabar mines. It is related to idrialite.

Napa County: 1, Aragotite occured on cinnabar at the Redington mine, Knoxville, Durand (2) p. 218, Hanks (12) p. 289, (20) p. 674. Hanks (20) p. 674 reports it also from the Aetna mine, and gives a partial analysis.

Santa Clara County: 1, It was first observed at the New Almaden mine impregnating siliceous dolomite, and was described by Durand (2) p. 218, Hanks (12) p. 289, (20) p. 674.

Yolo County: 1, A specimen from the California mine is reported by Hanks (12) p. 289.

*ARCANITE, 1908

Potassium sulphate, K_2SO_4

Orthorhombic. Thin plates. Vitreous luster. Colorless, yellowish. H. = 2. G. = 2.66.

Like thenardite in its reactions, except that the flame is violet.

Orange County: 1, As yellow crystals from Tunnel No. 1 of the Santa Ana Tin Mining Company in Trabuco Canyon, Eakle (9) p. 233. These

were pseudo-hexagonal due to twinning, and apparently are actually orthorhombic, so that the mineral is different from aphthitalite, which it closely resembles.

This is the first recorded natural occurrence of this mineral, although the artificial compound was known earlier.

ARGENTIAN GOLD

See gold, variety argentian (electrum)

ARGENTITE

Silver sulphide, Ag_2S

Isometric. Octahedral crystals, often distorted. Commonly in arborescent and reticulated shapes. Sectile. Metallic luster. Color dark lead gray to black. Streak black. H. = 2-2½. G. = 7.2-7.36.

Heated on charcoal, it gives a slight odor of sulphur and is readily reduced to a bead of metallic silver. Acanthite is the orthorhombic form of Ag_2S and is the stable form at ordinary temperatures. It is quite possible that most so-called argentite is acanthite, pseudomorphous after argentite.

Alpine County: **1,** Argentite occurs sparingly in a number of mines in the Monitor district, south of Markleeville, associated with polybasite, pyrargyrite, and other sulpho-salts, Conkling (1) p. 184, Eakle (16) p. 13.

Imperial County: **1,** Reported in a gold quartz vein, with some silver, in the Mary Lode mine (secs. 14, 15, T. 12 S., R. 18 E., S. B.), Sampson and Tucker (18) p. 122. **2,** In several mines in the Paymaster district, 3 miles southeast of Midway Well, Tucker (11) p. 267.

Inyo County: **1,** It was found with tetrahedrite and stephanite in the Belmont mine, Cerro Gordo district, Tucker (4) p. 283. **2,** Occurred with stephanite at the Oriental mine in Deep Spring Valley, Hanks (15) p. 93. **3,** Found at the Cliff mine, Goodyear (3) p. 237. **4,** It was an important mineral in the Minietta Belle mine, Hanks (15) p. 93. **5,** Found with native silver on the southwest border of Saline Valley, T. Warner (1) p. 938. **6,** Masses of argentite are reported from the Darwin district, Kelley (4) p. 543. **7,** Crystals were reported by Aaron from the Kearsarge area, Hanks (12) p. 75. **8,** Ragged masses, matted with quartz crystals and gold, came from the Silver Sprout vein in the same district, W. P. Blake (14) p. 125. **9,** It is found with cerargyrite in the Wild Rose district, De Groot (2) p. 213. **10,** Found in the Lee mine 18 miles east of Keeler, Tucker (11) p. 488. **11,** At the Sunrise mine in the Panamint district, Stetefeldt (1) p. 259. **12,** Small amounts of argentite occur with the nickel and cobalt minerals at Long Lake (sec. 14, T. 9 S., R. 31 E., M. D.), Tucker and Sampson (25) p. 378.

Kern County: **1,** Argentite occurs with tetrahedrite and pyrargyrite at the Amalie mine, Crawford (2) p. 605. **2,** It is found in several mines on Soledad Butte, in the Mojave mining district, Bateson (1) p. 176, Hamilton and Root (5) p. 157, Tucker and Sampson (21) p. 298.

Los Angeles County: **1,** It occurred with native silver and arsenates at the Kelsey and O. K. mines, in San Gabriel Canyon 8 miles from Azusa, Irelan (4) p. 47, Storms (4) p. 244.

Mariposa County: **1,** With pyrargyrite at the Silver Bar (Bryan) mine 6 miles southeast of Mariposa (sec. 15, T. 6 S., R. 19 E., M. D.), Laizure (6) p. 123, (8) p. 44.

Mono County: **1**, Argentite occurs in small amounts in the Bodie district, Whiting (1) p. 389; **2**, in the Benton district, Hanks (12) p. 75, with native silver and gold. **3**, In the Patterson district, Sweetwater Range, it occurs with gold, native silver and cerargyrite in quartz, Whiting (1) p. 359.

Napa County: **1**, It is reported at the Palisade mine (sec. 24, T. 9 N., R. 7 W., M. D.), northeast of Calistoga, W. W. Bradley (1) p. 270. **2**, At the Mount St. Helena mine in the same district, with cerargyrite, Boalich (4) p. 159.

Nevada County: **1**, It occurs with pyrargyrite and stephanite at the Allison Ranch mine, 2½ miles south of Grass Valley, Lindgren (12) p. 119. **2**, It was found at the Banner mine, 5 miles east of Grass Valley, Chandler (1) p. 4.

Orange County: **1**, Argentite is reported with argentiferous galena at Silverado (N. R.).

Placer County: **1**, Argentite occurs in gold quartz with a little galena and tellurides, at the Alabama mine 1 mile east of Penryn, Logan (17) p. 11. **2**, The Eclipse mine, (NW¼ sec. 17, T. 12 N., R. 8 E., M. D.), ibid, p. 22.

Riverside County: **1**, It was found with carbonates in the Palen Mountains, F. J. H. Merrill (2) p. 526.

San Bernardino County: **1**, It occurs, usually with cerargyrite, in the mines in the New York Mountains, Tucker and Sampson (16) p. 276. **2**, In the Lava Bed district (T. 7 N., R. 4 and 5 E., S. B.), De Groot (2) p. 529. **3**, In the mines at Calico, Weeks (2) p. 762. **4**, Found with sulphides in the Goldstone district, 33 miles north of Barstow, Cloudman et al. (1) p. 805. **5**, With cerargyrite at the War Eagle mine 9 miles north of Bagdad, Tucker (4) p. 366.

Shasta County: **1**, It is found with native silver, freibergite, etc., at the Big Dike mine, in the South Fork district (secs. 17, 18, T. 31 N., R. 6 W., M. D.), Laizure (1) p. 526. **2**, At the Silver King mine, Middletown district (sec. 8, T. 31 N., R. 5 W., M. D.), Laizure (1) p. 528.

Tuolumne County: **1**, Argentite occurs with sphalerite in quartz at Frazer's mine, J. B. Trask (1) p. 23.

ARSENIC

Native arsenic, As

Hexagonal-rhombohedral. Generally granular massive; sometimes reticulated, reniform, stalactitic. Perfect basal cleavage. Brittle. Metallic. Color and streak tin white, tarnishing to dark gray. H. = 3½. G. = 5.7.

Heated on charcoal, very volatile white fumes are obtained similar to antimony, but more difficult to catch on the coal; fumes have strong garlic odor.

Inyo County: **1**, Richthofen (3) p. 46 reported native arsenic from the Owens River.

Monterey County: **1**, It was recorded from the old Alisal silver mine, about 8 miles southeast from Salinas, by W. P. Blake (7) p. 301.

Nevada County: **1**, S.M.B. (19841), from the Alcalde mine at Deadman Flat, 4 miles southwest of Grass Valley, carries native arsenic and gold in calcite. **2**, W. D. Johnston, Jr. (2) p. 340, (4) p. 36, observed botryoidal pieces of arsenic, some with free gold, on the 1600 level of the Empire mine at Grass Valley.

ARSENIOSIDERITE

Basic calcium and iron arsenate, $Ca_3Fe(AsO_4)_3 \cdot 3Fe(OH)_3$

Tetragonal or orthorhombic. In fibrous concretions. Basal cleavage. Luster silky. Color yellowish brown. H. = 1½. G. = 3.5-3.9.

Easily fusible. Soluble in acid.

San Bernardino County: **1**, Found by B. N. Moore at the Gallinger-Root mines 2 miles northwest of Ludlow, and analyzed by Charles Milton, R. C. Wells (3) p. 117.

ARSENOLITE—White Arsenic

Arsenic oxide, As_2O_3

Isometric. Commonly in fibrous crusts and earthy. Octahedral cleavage. Silky or vitreous luster. Colorless or white. H. = 1½. G. = 3.7.

Fusible, yielding white fumes and garlic odor.

Alpine County: **1**, Arsenolite crystals up to half an inch in diameter were formed on the dumps of the Exchequer mine in the Monitor district, by the addition of water to burning enargite ore, Hanks (12) p. 76. **2**, Arsenolite was also found in small white octahedrons with realgar at the Monitor mine, ibid. p. 344.

San Bernardino County: **1**, Large masses of arsenolite were found at the Amargosa mines, in the sink of the Amargosa River (T. 18 N., R. 7 E., S. B.), W. P. Blake (9) p. 8, (30) p. 292.

Trinity County: **1**, Re-examination shows claudetite reported from here [Landon (1) p. 279] to be in all probability arsenolite; some of the octahedral crystals are as much as 1 mm. in size, Switzer (p.c. '49).

ARSENOPYRITE

Sulpharsenide of iron, FeAsS

Monoclinic, pseudo-orthorhombic. Common in crystals. Generally compact to granular massive. Brittle. Metallic luster. Color silver white to steel gray. Streak grayish black. H. = 5½-6. G. = 5.9-6.2.

Copious white volatile fumes of arsenic oxide and a strong garlic ordor are obtained when arsenopyrite is roasted on charcoal. Residue becomes magnetic. Borax bead is yellow to pale green. Decomposed by nitric acid with the separation of sulphur.

Danaite is cobalt-bearing arsenopyrite.

Arsenopyrite is very widespread in the gold-quartz veins of the state, usually as one of the minor gangue minerals, and associated with pyrite and chalcopyrite. It is impracticable to list all occurrences, but the mineral is common in the Mother Lode ores, and in the gold deposits of Siskiyou, Shasta, and Trinity Counties. Only those occurrences of peculiar interest or importance can be mentioned.

Alpine County: **1**, Well-formed crystals are reported from the old Morning Star mine, near Markleeville, Nichols (1), p. 172.

Amador County: **1**, At the Gwin mine, near Jackson, it was found ". . . in both large and small crystals. The former are particularly prized as they enclose arborescent masses of crystallized gold," F. L. Ransome (9) p. 8.

Calaveras County: **1**, A cobaltiferous variety occurs on the Hauselt Patent, 2 miles southeast of Sheepranch (NW¼ NW¼ sec. 22, T. 4 N., R. 14 E., M. D.). It is fine grained, and on exposure to the air becomes coated with erythrite, Hess (19) p. 451. It is found in many other mines in the county.

Del Norte County: **1,** Found in the gold-quartz veins of several mines along Shelley Creek and upper Monkey Creek, Maxson (1) pp. 143, 144.

El Dorado County: **1,** Many of the Mother Lode mines carry some arsenopyrite, Logan (16) pp. 34, 35, etc.

Fresno County: **1,** It is abundant in the Jenny claim (NW¼ sec. 16, T. 13 S., R. 27 E., M. D.), W. W. Bradley (2) p. 446.

Imperial County: **1,** Arsenopyrite is found in the Cargo Muchacho district, Hanks (12) p. 240.

Inyo County: **1,** It occurs with löllingite, pyrrhotite, and other sulphides in the Wilshire gold mine at the headwaters of Bishop Creek, Schroter (2) p. 53. **2,** With cobalt aud silver minerals at Long Lake, Tucker and Sampson (25) p. 378. **3,** In the Panamint district at the head of Happy Canyon, Murphy (2) p. 317.

Kern County: **1,** Numerous localities in and near the Green Mountain district carry arsenopyrite, Tucker and Sampson (21) pp. 299, 304, 310, 325. **2,** It is common at the Yellow Aster and neighboring mines near Randsburg, Hulin (1) p. 83. **3,** A vein 6 to 12 inches in width was mined for arsenic at the Contact mine (sec. 10, T. 10 N., R. 15 W., S. B.), Tucker (8) p. 368.

Mariposa County: **1,** The cobaltiferous variety, *danaite*, occurs with erythrite and mariposite at the Josephine mine, in Bear Valley, Turner (12) p. 679. **2,** The common variety is found in many other mines in the county.

Mono County: **1,** It is common in the gold ores of the Sierra area, Mayo (4) pp. 83, 85.

Monterey County: **1,** Arsenopyrite occurs in gold-quartz veins in Los Burros district, Hill (4) p. 327. **2,** At the head of Chualar Canyon, Laizure (3) p. 28.

Napa County: **1,** It is found at the Palisades mine 2 miles north of Calistoga, Hulin (p.c. '36).

Nevada County: **1,** The variety *danaite* occurs in well-formed, brilliant crystals up to a quarter of an inch in size, at Meadow Lake, W. P. Blake (14) p. 298. **2,** Arsenopyrite is common but irregularly distributed in the gold veins of Grass Valley and Nevada City, Lindgren (12) p. 118. **3,** Laur (1) p. 1099 observed "pyrite blanche" in radial concretions at Grass Valley.

Placer County: **1,** Arsenopyrite occurs in the Ophir district, Lindgren (7) p. 273. **2,** Canada Hill and Dutch Flat district, C. A. Waring (4) p. 340, 350. **3,** At the Metallic mine near Cisco, it is associated with cobaltite, S. M. B. (1901).

Riverside County: **1,** Arsenopyrite occurs in crystals replacing löllingite at Crestmore, Kelley (2) p. 141. **2,** It is found in the ore with barite and fluorite at the Cajalco tin mine, West (3) p. 132.

San Bernardino County: **1,** Arsenopyrite occurs at the Grand View and other mines in the Ord Mountains, Gardner (1) p. 261. **2,** Sometimes in considerable amount in the California-Rand mine, just east of the Kern County line, Hulin (1) p. 83. **3,** At the American mine (sec. 19, T. 4 N., R. 11 E., S. B.), Tucker and Sampson (27) p. 54.

San Diego County: **1,** It is found with quartz and pyrrhotite in the gold veins of the Julian district, Donnelly (1) p. 359. **2,** Abundant

arsenopyrite occurs in quartz veins of the Willhite group 9 miles east of Descanso, Tucker and Reed (26) p. 12. **3**, Lenses of massive arsenopyrite occur in veins at the Black Mountain mine (sec. 5, T. 14 S., R. 2 W., S. B.), Tucker (10) p. 329.

Santa Clara County: **1**, Minor amounts are found in the mercury ores of the New Almaden mine, W. P. Blake (1) p. 439.

Santa Cruz County: **1**, Small crystals are abundantly disseminated in crystalline limestone, at the Pacific Limestone Products quarry at Santa Cruz, Vonsen (p.c. '36).

Shasta County: **1**, Arsenopyrite is found in the gold ores at a number of localities near the western edge of the county, Averill (4) pp. 12, 50, 57 (cf. Trinity County).

Sierra County: **1**, It is the principal vein sulphide in the gold ores of the Alleghany district, Ferguson (2) p. 163. **2**, Arsenopyrite rich in gold comes from the Eagle mine, Kanaka Creek, S. M. B. (7768). **3**, It is associated with tellurides at the North Fork claim, Forest City, Hanks (12) p. 77. It is common in many other mines in the county.

Siskiyou County: **1**, Arsenopyrite is plentiful with pyrite in the massive ore of the Dewey mine near Gazelle, Mining and Scientific Press (29) p. 9.

Trinity County: **1**, Along the eastern edge of the county, near the Weaverville area, arsenopyrite is a moderately common mineral in the gold ores, Averill (10) pp. 28, 42, 64 (cf. Shasta County).

Tulare County: **1**, It is a minor ore mineral in the mines of the Mineral King district, Goodyear (3) p. 646, Franke (1) p. 436.

Tuolumne County: **1**, The variety *danaite* is found with erythrite at the Josephine mine, Logan (16) p. 189.

Yuba County: **1**, Arsenopyrite occurs in a gold vein, with chalcopyrite and tellurides at the California M Lode, in the Indiana Ranch district 2 miles northwest of Dobbins (T. 18 N., R. 7 E., M. D.), C. A. Waring (4) p. 446.

Additional references to minor occurrences are as follows: *Amador*, F. L. Ransome (9) p. 8; *Calaveras*, Tucker (1) p. 74, Franke and Logan (4) p. 239; *Kern*, Goodyear (3), p. 321; Tucker and Sampson (21) pp. 299, 304, 310, 325; *Mariposa*, R. W. Raymond (8) p. 52; *Nevada*, J. B. Trask (5) p. 86; *Placer*, Hanks (12) p. 77, W.W. Bradley (22), p. 18; *Riverside*, R. J. Sampson (9) p. 513; *Siskiyou*, Averill (5) p. 280; *Trinity*, Averill (4) p. 26.

ARTINITE

Hydrous basic magnesium carbonate, $Mg_2(CO_3)(OH)_2 \cdot 3H_2O$

Monoclinic. As crusts of acicular crystals. Botryoidal masses of silky fibers, as spherical aggregates of radiating fibers and as cross-fiber veinlets. Pinacoidal cleavage (100) perfect, basal pinacoidal (001), good. Brittle. H. = $2\frac{1}{2}$. G. = 2.02. Color and streak, white. Luster of fibrous aggregates, silky, of individual crystals, vitreous. Transparent.

B.B. whitens but does not fuse. Easily soluble with effervescence in cold acids.

San Benito County: **1**, Acicular crystals of artinite occur on fractures in serpentine at a chrome prospect near New Idria, Dickson and Murdoch (p.c. '54).

ASBESTOS

See serpentine; amphibole

ASBOLITE

See psilomelane

ASCHARITE

See szaibelyite

ATACAMITE

Hydrous copper oxychloride, $Cu_2Cl(OH)_3$

Orthorhombic. Slender needles and fibrous reticulated masses. One cleavage highly perfect. Brittle. Luster adamantine to vitreous. Color bright to black green. Streak apple green. H. = 3-3½. G. = 3.7.

Fuses and imparts an azure-blue color to the flame. Readily reduced on charcoal to metallic copper. Gives much acid water in a closed tube, and forms a gray sublimate. Easily soluble in acids.

Inyo County: **1**, J. D. Dana (4) p. 786 recorded atacamite from this county. As the Cerro Gordo mine was the best known for rare minerals, it may perhaps have come from this mine.

Kings County: **1**, It has been reported from Avenal Creek (T. 23 S., R. 16 E., M. D.), W. W. Bradley (29) p. 456. This is a doubtful occurrence.

San Bernardino County: **1**, A specimen from 2 miles southeast of Goffs, carried small crystals of atacamite in a vug. This is represented by S. M. B. (19428), and was identified by Foshag (p.c. '46).

AUGELITE

Hydrous aluminum phosphate, $2Al_2O_3 \cdot P_2O_5 \cdot 3H_2O$

Monoclinic. In tabular crystals and massive. Good prismatic cleavage. Luster vitreous, pearly on cleavage surfaces. Colorless to white. H. = 5. G. = 2.5-2.7.

B.B. infusible. Little affected by acids. Yields much water in a closed tube.

Mono County: **1**, Crystals of this rare mineral up to three-quarters of an inch or more in size have been found in the great andalusite ore body of the Champion Sillimanite Company, on the west slope of the White Mountains, Lemmon (1) p. 664. Complex crystals have been described by Pough (1) p. 536, and the x-ray structure has been worked out by Peacock and Moddle (1) pp. 111-113.

AUGITE

See pyroxene

AURICHALCITE

Basic carbonate of zinc and copper, $2(Zn,Cu)CO_3 \cdot 3(Zn,Cu)(OH)_2$

Monoclinic. Plumose, tabular, laminated; in drusy incrustations. Pearly luster. Color and streak pale green to sky blue. H. = 2. G. = 3.54-3.64.

On charcoal, when mixed with sodium carbonate, it gives yellow coating of zinc and globules of copper. Easily soluble with effervescence. In a closed tube blackens and gives water.

Inyo County: **1**, It occurs with hemimorphite and hydrozincite at the Cerro Gordo mine, A. F. Rogers (7) p. 374. **2**, It is found in the Defiance mine, in the Darwin district, as fibrous radiating clusters and coatings, with linarite, and often coated with hemimorphite, Murdoch and Webb (14) p. 323. **3**, Specimen S. M. B. (21321) came from one mile east of

Dodd Spring, Ubehebe mining district. **4**, It occurs in blue spherulitic globules on matrix from the War Eagle mine, near Tecopa, Woodhouse (p.c. '54).

Mono County: **1**, It is found as pale-green fissure fillings in magnetite containing sphalerite, near Topaz. There is no written record of this occurrence except a statement by Eakle (22) p. 143, but it is probably an authentic occurrence.

AUTUNITE

Hydrous uranium and calcium phosphate, $CaO \cdot 2UO_3 \cdot P_2O_5 \cdot 8H_2O$

Orthorhombic. In thin tabular crystals; also foliated, micaceous. Cleavage perfect basal. Brittle. Luster pearly, subadamantine. Color lemon yellow. Streak yellow. H. = 2-2½. G. = 3.1.

Fuses easily to a black mass giving a pale-greenish flame. Gives green bead with phosphorous salt. Soluble in nitric acid.

Meta-autunite I and II are not known in nature, but appear in laboratory specimens after exposure to air.

Inyo County: **1**, Autunite is reported as occurring disseminated in clay beds, on the Green Valley claim, N½ sec. 25, T. 19 S., R. 37 E., M. D., Anon. (27) p. 5.

Kern County: **1**, A specimen showing crusts of autunite from Summit Diggings is in the University of California collections at Berkeley, and is probably the same as the one referred to by Hanks (15) p. 8 as from the Randsburg district; see also Anon. (25) p. 14. **2**, Autunite and meta-autunite occur at the Rosamond prospect, N½ sec. 25, T. 10 N, R. 13 W., S.B., 10 miles south of Mohave, Walker (1), p. 3. **3**, Autunite and torbernite have been found on the property of the Miracle Mining Company, near Miracle Hot Springs, in Kern Canyon, Anon. (26) p. 18.

San Bernardino County: **1**, Specimens of yellow autunite with green plates of torbernite are reported to have come from the northeastern part of the county. There is no written record of this occurrence beyond a statement in Eakle (22) p. 238, but it is probably authentic.

AWARUITE—Terrestrial Nickel-Iron

Native alloy of nickel and iron, near $FeNi_2$

Isometric. Grains and nuggets. Tin-white to steel-gray color. Magnetic. H. = 5. G. = 8.1.

Del Norte County: **1**, It has been found as small (0.15-1.5 mm) rounded grains in the heavy residues of sands of the South Fork, Smith River, Jamieson (1) p. 414.

AXINITE

Aluminum and calcium borosilicate, with iron and manganese, $H(Ca,Mn,Fe)_3BAl_2(SiO_4)_4$

Triclinic. Thin wedge-shaped crystals. Sometimes granular massive. One cleavage distinct. Vitreous luster. Color clove brown, yellow, plum blue, violet, white. Streak uncolored. H. = 6½-7. G. = 3.27-3.29.

Fuses with swelling and intumescence, and may show slight greenish flame. Powder mixed with potassium bisulphate and fluorite, and held on platinum wire in the Bunsen flame, will give a momentary green flame of boron. Insoluble in acid.

Amador County. **1**, Crystals to 1 inch long found in vein cutting limestone in quarry on Allen Ranch, 4 miles west of Martell. Bowen, (p.c. '55).

Butte County: **1**, Abundant loose crystals and clusters of crystals, plum colored and of the usual platy habit were found in the gold placers at Yankee Hill, Wilke (p.c. '36).

El Dorado County: **1**, Small clear crystals with many faces, and brown in color, were found on epidote at the old Cosumnes copper mine 3 miles northeast from Fairplay, Schaller (18) p. 42. **2**, Thin-bladed masses of violet-colored axinite occur in veins on the northeast side of Lily Lake (T. 12 N., R. 17 W., M. D.), Clark (p.c. '36).

Inyo County: **1**, Axinite was reported from the Funeral Range, Kunz (24) p. 96. **2**, Perfectly formed small white crystals were found with smithsonite at the Ubehebe mine, Eakle (22) p. 188. A specimen of axinite, with well-developed crystals in epidote, S. M. B. (21320), from the south end of Butte Valley, Ubehebe mining district, probably represents this same locality. **3**, It has been doubtfully reported from Sheppard Canyon 14 miles west of Ballarat, S. M. B. (21192).

Kern County: **1**, Bladed subhedral crystals, plum color to brownish blue occur in a contact zone on the south fork of Erskine Creek (sec. 6, T. 28 S., R. 33 E., M. D.), Murdoch and Webb (11) p. 552. **2**, Small plum-colored crystals with massive wollastonite, are found in a contact deposit on the Rademacher-Terese siding of the Owens Valley Branch of the Southern Pacific Railroad (T. 27 S., R. 39 E., M. D.), Murdoch and Webb (11) p. 553.

Madera County: **1**, Large violet-colored crystals, some of gem quality, with accessory sphene, occur in a small pegmatite about 5 miles northeast of Coarse Gold, W. W. Bradley (29) p. 310, Over (p.c. '45).

Marin County: **1**, Crystals, with associated prehnite are found in the hills around the Stinson ranch, Vonsen (p.c., '45).

Mono County: **1**, Plum-colored crystals up to 1 inch in size occur in vugs and fissures in metamorphic rock 200 yards northwest of the southern shore of a large unmapped lake at the southeast base of Mount Baldwin, Chelikowsky (p.c., '36).

Monterey County: **1**, Pale lavender crystals of axinite occur with epidote and quartz in metamorphosed serpentine, at Lime Kiln Creek, Chesterman (p.c., '51).

Placer County: **1**, Massive crystalline axinite in epidote rock has come from the north summit point of a ridge south of Five Lakes (sec. 7 (?), T. 15 N., R. 16 E., M. D.), Wood (p.c., '36).

Riverside County: **1**, Very large purple crystals have been collected from the old city quarry, North Hill, Riverside, A. F. Rogers (7) p. 378. **2**, Thin purple blades of axinite have been found in some of the Crestmore pegmatites, Woodford et al. (10) p. 358.

San Bernardino County: **1**, Axinite has been collected in the Owl Mountains, Kunz (24) p. 96. **2**, Axinite occurs with zoisite in the Henshaw quarry, SE$\frac{1}{4}$ sec. 33, T. 1 S., R. 5 W., S. B., Cooney (p.c., '53).

San Diego County: **1**, Smoky pink crystals, brilliant and perfectly transparent occurred in pockets of a pegmatite (?) with crystalline quartz, at the Freeman mine, near Bonsall (E$\frac{1}{2}$ sec. 27, T. 10 S., R. 3 W., S. B.), Schaller (18) p. 37.

Siskiyou County: **1**, Big, pale-pinkish crystals occur in a 2- to 6-inch vein, in a road cut near the crossing of the Klamath River, between Yreka and Hornbrook, Vonsen (p.c., '45). **2**, S. M. B. (20825), is from the Humbug mining district, just northwest of Yreka, W. W. Bradley (23) p. 85.

Tulare County: **1,** Crystals of axinite up to three-quarters of an inch across occur with epidote at the Consolidated tungsten mine, Drum Valley, Noren (p.c., '54).

AZURITE

Basic cupric carbonate, $2CuCO_3 \cdot Cu(OH)_2$

Monoclinic. Good crystals, massive, earthy. Cleavage, one perfect. Brittle. Vitreous to adamantine luster. Color deep azure blue. Streak light blue. H. = 3½-4. G. = 3.77-3.89.

Similar to malachite in reactions, but easily distinguishable by color.

Although not as common as malachite, azurite is nevertheless widespread in its occurrence, often merely as blue stains or coatings in deposits of copper, or other ores containing even traces of copper minerals. Only those occurrences of reasonable importance or interest are listed.

Calaveras County: **1,** Fine specimens of azurite and malachite have come from the Hughes mine, W. P. Blake (9) p. 8. **2,** It has been found in the mines at and near Copperopolis, Hanks (12) p. 77, Reid (3), p. 398, and in other mines of the county.

El Dorado County: **1,** Good specimens have been found at the Alabaster Cave, Cosumnes, and other mines in the Foothill copper belt, Aubury (4) p. 213, Tucker (3) pp. 276-278.

Imperial County: **1,** It occurs with malachite at the Volunteer and Cave Man mines (secs. 23, 26, T. 12 S., R. 20 E., S. B.), Tucker (11) p. 252. **2,** Found in the Cargo Muchacho district, Henshaw (1) p. 185.

Inyo County: **1,** Azurite has been found with oxide, silicate and green carbonate of copper in the Greenwater district, Black Mountains, south of Furnace Creek, C. A. Waring and Huguenin (2) p. 70. **2,** A little was found in the Panamint district, Murphy (2) p. 322. **3,** Occurs with anglesite, bindheimite, and malachite at the Modoc mine, Hanks (12) p. 71. **4,** In the Cerro Gordo district, ibid. p. 71.

Kern County: **1,** Found with sulphides and oxides at the Greenback mine in the Woody district, Storms (13) p. 635. **2,** It has also been reported with oxidation minerals in the Cinco district (N.R.), and **3,** from San Emigdio Canyon (N. R.).

Lake County: **1,** Azurite occurs with malachite at the Copper Prince mine 4 miles northwest of Middletown (sec. 19, T. 11 N., R. 7 W., S. B.), Aubury (1) p. 138.

Los Angeles County: **1,** It was early discovered on the east end of Santa Catalina Island, Mining and Scientific Press (5) p. 263.

Madera County: **1,** Found at the old Buchanan and Ne Plus Ultra mines near Daulton (T. 8 and 9 S., R. 18 E., M. D.), Aubury (1) pp. 218, 220.

Mariposa County: **1,** Many mines in the county carry minor amounts of azurite, J. R. Browne (4) p. 27, Aubury (1) pp. 204-213, Liebenam (1) p. 543. **2,** Fine crystals have been reported from the Hawlington district (N. R.).

Mendocino County: **1,** Reported from the Redwood Copper Queen (secs. 17, 20, T. 12 N., R. 13 W., M. D.), Aubury (1) p. 137.

Modoc County: **1,** Found at the Seitz mine, 7 miles southwest of Fort Bidwell, Tucker (3) p. 241.

Mono County: **1,** Aggregates of small crystals came from the Diana mine, A. W. Jackson (3) p. 371. **2,** It was reported from the Detroit

mine, Jordan district, with malachite and cuprite, Whiting (1) p. 364. **3**, It occurs sparingly at the Kerrick mine, Blind Spring Hill, A. L. Ransome (2) p. 190, and **4**, at Copper Mountain, 16 miles southwest of Bodie, ibid. p. 120.

Monterey County: **1**, Found with arsenopyrite on the Riley ranch at the head of Chualar Canyon, Laizure (3) p. 28.

Nevada County: **1**, Occurs with malachite at the Zinc House mine, near Empire Ranch, Aubury (1) p. 27.

Placer County: **1**, Reported from the Algol mine (sec. 9, T. 13 N., R. 7 E., M. D.), near Auburn, Aubury (1) p. 173. **2**, It was found by Silliman (7) p. 351 with oxides and sulphates in the Valley View mine at Whiskey Hill, near Lincoln.

Plumas County: **1**, Found at various properties near Taylorsville (secs. 1, 11, 12, T. 24 N., R. 11 E., M. D.), Averill (8) p. 93.

Riverside County: **1**, It is found at Crestmore in small amount, Eakle (15) p. 353. **2**, In the McCoy Mountains and Palen Mountains, F. J. H. Merrill (2) p. 525. **3**, At the Black Eagle mine, Eagle Mountains, Tucker (8) p. 195. **4**, At the Lost mine, Pacific mining district, Orcutt (2) p. 903.

San Bernardino County: **1**, Azurite is abundant with chrysocolla in the silver ores of the Calico district, Weeks (2) p. 762. **2**, It occurs in many of the mining districts of the county, in small amounts: Clark Mountains, Tucker (4) p. 339; Ord Mountain district, Tucker and Sampson (28) p. 237; Signal district, Old Dad Mountain, and Bumper group, Cloudman et al. (1) p. 785; Whipple Mountain district, Calarivada, Halloran Springs, Tucker and Sampson (17) pp. 266, 269, 273; Shadow Mountain, Tucker (4) p. 341.

San Diego County: **1**, Azurite occurs with chalcopyrite and malachite at the Daley mine (sec. 11, T. 13 S., R. 1 E., S. B.), Tucker (8) p. 370.

Santa Barbara County: **1**, A small amount was found at the Laguna Ranch mine, (3 miles west of sec. 5, T. 7 N., R. 29 W., S. B.), Cloudman et al. (1) p. 735.

Santa Clara County: **1**, Occurs at the Hooker Creek mine, 7 miles south of Los Gatos, Huguenin and Castello (4) p. 184. **2**, It occurred with crystallized cinnabar in calcite at the Guadalupe mine, Kunz (24) p. 107.

Shasta County: **1**, Found with native copper and sulphides in the Greenhorn mine, French Gulch mining district (sec. 6, T. 32 N., R. 7 W., M. D.), Tucker (9) p. 433. **2**, At Bully Hill, Diller (7) p. 128. **3**, At the Peck mine, Copper Hill, S. M. B. (800).

Siskiyou County: **1**, Found in minor amounts in gold veins of the Bonanza mine near Honolulu, Logan (8) p. 433. **2**, In the cliffs above the glacier on the north side of Mount Caesar, at the head of Little South Fork, Salmon River, Goudey (p.c., '36).

Sonoma County: **1**, Small amounts are present at the Cornucopia mine (secs. 33, 34, T. 12 N., R. 9 W., M. D.), W. W. Bradley (1) p. 320. **2**, At Altamont (sec. 17, T. 7 N., R. 10 W., M. D.), Aubury (4) p. 167. **3**, Small perfect crystals have been reported 8 miles northeast of Cazadero (N. R.)

Trinity County: **1**, Occurs in small amount at Island Mountain, Vonsen (p.c., '45).

Tulare County: **1**, It was found with "silver sulphides" at the Deer Creek silver mine 11 miles south of Porterville, Franke (1) p. 462.

2, At the Hart prospect (sec. 2, T. 15 S., R. 28 E., M. D.) in the Redwood Canyon district, ibid. p. 435.

Tuolumne County: **1,** Found at the McKay Ranch (sec. 28, T. 1 N., R. 14 E., M. D.), Aubury (1) p. 201.

Ventura County: **1,** Reported from the Prospect mine near Triunfo, Carter (p.c., '36). **2,** In the Ventura mine (T. 1 N., R. 18 W., S. B.) at the foot of the south slope of Simi Peak, associated with millerite and pentlandite, Tucker and Sampson (20) p. 257.

* BAKERITE, 1903

Hydrous calcium silico-borate, $Ca_4B_4(BO_4)(SiO_4)_3H_2O$

Amorphous. Massive. Color white to faint green. H. = 4½. G. = 2.7-2.9. Reactions the same as for howlite.

Inyo County: **1,** Bakerite has been found in a small prospect hole at the entrance to Corkscrew Canyon, in Death Valley, Larsen (11) p. 43, and in many of the side gulches in Corkscrew Canyon, Murdoch (p.c. '54.).

Los Angeles County: **1,** A finely crystalline crust on cavities in shale at the Sterling borax mine, Tick Canyon, has been shown by x-ray examination to be bakerite, Murdoch (p.c. '50). The bakerite is covered in part by celestite crystals.

San Bernardino County: **1,** At the Borax Consolidated Company mines, at Borate, in the Calico Mountains, bakerite, associated with howlite, was described and named by Giles (2) p. 353.

Analyses

	B_2O_3	CaO	SiO_2	H_2O	Al_2O_3,Fe_2O_3
White	27.74	34.88	28.45	8.30	0.63
Faint green	26.85	35.22	28.05	8.66	0.22

BARITE—Heavy Spar

Barium sulphate, $BaSO_4$

Orthorhombic. Tabular and prismatic crystals, massive, lamellar, granular, concretionary. Cleavage perfect basal and good prismatic. Brittle. Vitreous luster. Color white, yellow, brown. Streak white. H. = 2½-3½. G. = 4.3-4.6.

Fuses with decrepitation and colors the flame green. Fused with sodium carbonate and the fused mass leached with boiling water, gives the sulphate in solution, which can be tested with barium chloride, giving a precipitate of barium sulphate. Insoluble in acids.

Barite is a very common gangue mineral in vein deposits, and occurs widely throughout the state. Only the more important or interesting occurrences can be listed.

Alameda County: **1,** Crystals of barite from the Leona Heights deposit are in the Stanford University Collections.

Alpine County: **1,** It is a minor gangue mineral in the Morning Star mine, Monitor district, Hanks (12) p. 78.

Butte County: **1,** Auriferous barite was found at the Pinkston mine half a mile south of Big Bend (sec. 8, T. 21 N., R. 4 E., M. D.), Turner (12) p. 588.

Calaveras County: **1,** It is found in a number of the gold mines of the county, Hanks (12) p. 78. Granular masses occur at Quail Hill, Silliman (7) p. 351 and as gangue of the copper ores, Huttl (1) p. 62.

Contra Costa County: **1,** S. M. B. (10330) is from Mount Diablo.

El Dorado County: **1,** Barite "10 miles above Georgetown" is represented by S. M. B. (5991).

Humboldt County: **1,** Occurs in white crystalline veins up to a foot in width at Liscom Hill 8 miles northeast of Arcata, Laizure (3) p. 300. **2,** Occurs near Hoopa, S. M. B. (20938).

Imperial County: **1,** In the Paymaster district (T. 12 S., R. 20 E., S. B.), it occurs as the principal gangue mineral, with argentite, Tucker (11) p. 267. **2,** Small concretions of barite, sometimes hollow and lined with crystals, come from Coolidge Spring, a few miles south of Fish Springs and west of the old highway, Murdoch (p.c. '45).

Inyo County: **1,** Veins of barite occur in the Alabama Hills, near Independence, Hanks (12) p. 78, W. W. Bradley (12) p. 6. **2,** Barite occurs with free sulphur at the Defiance mine, Darwin, S. M. B. (7601). **3,** S. M. B. (7201) came from Bishop Creek. **4,** Barite occurs as pure white veins 2 to 5 feet wide in schists and slates in Gunter Canyon, 6 miles northeast of Laws, Tucker (11) p. 512, W. W. Bradley (12) p. 6. **5,** Occurs as gangue in the copper ores of the Greenwater district, with one 40-foot ledge at Ramsey, Zalinski (1) pp. 81, 82. **6,** Occurs in 6- to 8-foot veins in Warm Springs Canyon, Tucker and Sampson (25) p. 482. **7,** Occurs with quartz as gangue of the Furnace Creek copper mine, Nicholas (1) p. 1087. **8,** Found at the American mine, west of Zabriskie, C. A. Waring and Huguenin (2) p. 71. **9,** Occurs with tetrahedrite in Indian Valley, Hanks (12) p. 78. **10,** Found as gangue in a vein with sulphides and arsenates, on Long Lake (sec. 14, T. 9 S., R. 31 E., M. D.), Tucker and Sampson (25) p. 378.

Kern County: **1,** Good crystals have been collected from Pine Canyon, north of Mojave, Murdoch (p.c. '45).

Los Angeles County: **1,** Barite is the gangue of the silver-cobalt ore in the Kelsey mine, San Gabriel Canyon, Storms (4) p. 244. **2,** A large outcrop occurs in sec. 23, T. 1 N., R. 9 W., S. B., on the west fork of San Dimas Canyon, F. J. H. Merrill (2) p. 480. **3,** It is found at the Renton and Black Jack mines on Santa Catalina Islands, Gieser (1) p. 245. **4,** It is present in minor amounts in the Felix fluorite mine north of Azusa S. M. B. (13031). **5,** Extensive veins of barite, with many small crystals and aggregates appear in the sea cliffs of the Palos Verdes Hills, Rocks and Minerals (1) p. 120, Schwartz (2) p. 8.

Mariposa County: **1,** Barite with tetrahedrite and triboluminescent sphalerite occurs in the Fitch mine, (sec. 9, 10, T. 4 S., R. 15 E., M. D.), Eakle (5) p. 30. **2,** A large deposit of barite has been mined about 2 miles west of El Portal, Fitch (2) p. 461. **3,** A large deposit occurs near Jerseydale (sec. 17, T. 4 S., R. 20 E., M. D.), W. W. Bradley (12) p. 7.

Mono County: **1,** A 4-foot outcrop of barite occurs in the Mammoth Lake area (T. 4 S., R. 27 E., M. D.), R. J. Sampson (14) p. 132. **2,** Large handsome crystals have been found at the great andalusite deposit in the White Mountains, Woodhouse (p.c. '45). **3,** At the extreme northern tip of the county, near Coleville, is a considerable deposit of barite, Eakle and McLaughlin (17) p. 141.

Napa County: **1,** Pseudomorphs of quartz after barite have been found at the Redington mine, Durand (1) p. 211.

Nevada County: There are several large deposits of barite in the county, as well as numerous occurrences in gold veins. **1,** A 15-foot vein has been mined commercially at the Democrat barytes mine (sec. 24, T.

16 N., R. 10 E., M. D.), E. M. Boyle (1) p. 71. **2,** Massive white to creamy barite occurs at the Spanish barite deposit (NW¼ sec. 19, T. 18 N., R. 11 E., M. D.), Logan (20) p. 378. **3,** A large deposit occurs north of the old Spanish mine, 6 miles from Washington, Logan (7) p. 12. **4,** An extensive deposit is found on the Maguire property at Liberty Hill, 5 miles from Alta, Stose (1) p. 338. **5,** Auriferous barite has been found at the Malakoff mine, Hanks (12) p. 78. **6,** It occurs at Pine Hill, as seams in diabase, E. M. Boyle (1) p. 59.

Orange County: **1,** A large deposit of crystalline barite occurs as the gangue mineral of the cinnabar deposit at Red Hill, Fairbanks (4) p. 118, F. J. H. Merrill (2) p. 516, W. W. Bradley (12) p. 8.

Placer County: **1,** It occurs as one of the gangue minerals at Whiskey Hill, near Lincoln (sec. 26, T. 13 N., R. 8 E., M. D.), Silliman (7) p. 351.

Plumas County: **1,** Several large lenses of barite occur in slate 5 miles from Almanor (Ohio mine) (sec. 5, T. 26 N., R. 8 E., and sec. 32, T. 27 N., R. 8 E., M. D.), Averill (8) p. 92. **2,** Barite was reported by Edman in lead and copper ores in the north arm of Indian Valley, Hanks (12) p. 78. **3,** A vein 2 to 3 feet wide of fine granular barite occurs at the Pinkstown Ledge, half a mile south of the highest point of Big Bend Mountain, in the Bidwell Bar area, Turner (12) pp. 558. **4,** From the Diadem lode, ibid. p. 587.

Riverside County: **1,** Barite is one of the gangue minerals, with fluorite and arsenopyrite, in the tin ores at the Cajalco tin mine, West (3) p. 132.

San Benito County: **1,** Veins up to 6 feet in width have been exploited at the Bardin Ranch, on the southwest flank of Gabilan (Fremont) Peak, W. W. Bradley and Logan (7) p. 624.

San Bernardino County: **1,** It occurs as gangue in the silver ores of the Calico district, Tucker and Sampson (17) p. 358, Lindgren (1) pp. 721, 725. **2,** It is abundant in veins in and around Lead Mountain, (T. 10 N., R. 1 W., S. B.), near Barstow, Tucker (4) p. 334, (8) p. 199, Durrell (7), p. 7. **3,** Barite occurs north and northwest of Barstow, Tucker and Sampson (17) p. 371, (9) p. 254. **4,** Microscopic crystals have been found in the bones of the fossil beds, 6 miles northeast of Barstow, Howard (1) p. 120. **5,** A series of parallel veins occurs in basalt 3 miles north of Ludlow in the Hansen deposit, (T. 8 N., R. 8 E., S. B.), W. W. Bradley (12) p. 54. **6,** A 3-foot vein occurs in limestone 12 miles east of Victorville (T. 6 N., R. 2 W., S. B.), Tucker and Sampson (17) p. 279. **7,** Nodular barite with celestite in clay shales comes from Owl Holes (sec. 23, T. 18 N., R. 3 E., S. B.), Murdoch and Webb (11) p. 550. **8,** Stringers up to 12 inches occur at Foshay Pass, 26 miles southeast of Kelso, Tucker (4) p. 334. **9,** Occurs with calcite as the gangue of lead ores in the Lava Beds district, Tucker and Sampson (17) p. 351. **10,** Two- to six-inch stringers on limestone-schist contact are found 2 miles southeast of Afton, Tucker (4) p. 334. **11,** Barite, largely massive, forms a large proportion of the minerals of the bastnaesite locality at Mountain Pass, Pray (p.c. '51).

San Francisco County: **1,** Tabular crystals occur in seams in the serpentine of Fort Point, San Francisco, Eakle (1) p. 316.

San Luis Obispo County: 1, A 1- to 2-foot vein of barite occurs on the Fugler Ranch, 6 miles southeast of Arroyo Grande, Franke (2) p. 410. **2,** Rosettes of "sand barite" crystals have been found in limy

sandstone in the Cuyama Valley, J. W. Eggleston (p.c. '36). A specimen from the Caliente Range about 10 miles south of Taylor Springs, S.M.B. (21298), is from this occurrence.

Santa Barbara County: **1,** A 20-foot vein of white barite occurs on the north fork of La Brea Creek (secs. 5, 6, T. 10 N., R. 30 W., S. B.), about 20 miles northeast of Sisquoc, W. W. Bradley (12) p. 55. **2,** Another deposit has been reported on the Sisquoc about 15 miles southeast of Santa Maria, Crawford (1) p. 406.

Santa Clara County: **1,** Barite crystals of unusual habit occurred in seams in the manganese boulder of Alum Rock Park, A. F. Rogers (21) p. 447. **2,** It occurs in veins in an old cinnabar mine on Llagas Creek near Gilroy. **3,** In the Solis district, (N. R.)

Shasta County: **1,** It occurs as a gangue mineral in the mines of the Bully Hill district (T. 34 N., R. 4 W., M. D.), Aubury (1) p. 60, Logan (7) p. 7, Tucker (8) p. 429. **2,** At the Glidden (Loftus) barytes, Tom Neal Creek (sec. 19, T. 38 N., R. 3 W., M. D.), Laizure (1) p. 515. **3,** 12 miles north of Montgomery Creek (sec. 33, T. 36 N., R. 1 W., M. D.). **4,** Near Baird (sec. 29, T. 34 N., R. 3 W., M.D.), Logan (9) p. 129.

Siskiyou County: **1,** Barite is one of the vein minerals with galena, 3 miles from Callahan on Boulder Creek, Logan (7) p. 181.

Trinity County: **1,** Dark-gray barite comes from about 15 miles below Hay Fork Postoffice on the Hay Fork of Trinity River, S. M. B. (13716). **2,** At the Five Pines mine it occurs as small crystals associated with pink calcite (N. R.). **3,** It also is found at the Delta mine, Ferguson (1) p. 43.

Tulare County: **1,** An extensive deposit occurs at the Paso-Baryta Mines, Ltd., deposit in the southeastern part of the county (secs. 23, 24, T. 24 S., R. 36 E., M. D.), Tucker and Sampson (25) p. 481. **2,** It is found on the Bowman ranch, 15 miles east of Exeter, Franke (1) p. 431. **3,** At the Bald Mountain deposit near Rattlesnake Creek on the upper Kern River. Franke (1) p. 431. **4,** It was found near Springville, Stoddard (5) p. 1129.

BARKEVIKITE

See amphibole, soda amphibole

BARYTOCELESTITE

See celestite

BASSANITE

Hydrous calcium sulphate, $2CaSO_4 \cdot H_2O$

Monoclinic, pseudo-hexagonal. Snow-white, fibrous. G. = 2.7. H. undetermined.

Inyo County: **1,** Bassanite occurs as thin layers in unconsolidated beds at a depth of 360 feet, in the dry lake near Ballarat, Panamint Valley, in long, snow white fibers, Allen and Kramer, (1) p. 1266.

San Bernardino County: **1,** Bassanite, in snowy white, long fibers, is found in drill holes at depths of 365 and 510 feet, in unconsolidated sediments in Danby Dry Lake, T.1, 2 N., R. 17, 18 E., S. B. Allen and Kramer (1) p. 1266.

BASTNAESITE

Rare earth fluo-carbonate, essentially $(Ce,La)(CO_3)F$

Hexagonal, usually massive, occasionally tabular crystals. Cleavage indistinct. Luster vitreous to greasy. H. = 4-4½. G. = 4.9-5.2. Color wax yellow to reddish brown. Transparent to translucent.

San Bernardino County: **1**, Bastnaesite occurs in relative abundance, largely in dolomitic breccias associated with syenitic intrusives, along an extensive zone at Mountain Pass, Pray and Sharp (1) p. 1519, Olson and Sharp (1) p. 1467, Anon. (15), p. 1 and (13), p. 2. A comprehensive report on the minerals of the Mountain Pass region is found in Olson et al., (3).

BASTITE

See serpentine

BAUXITE

See gibbsite

BAVENITE

Hydrous beryllium, aluminum, and calcium silicate, $Ca_4BeAl_2Si_9O_{25}(OH)_2$

Monoclinic. In fibrous-radiated groups of prismatic crystals. One cleavage. Colorless to white. H. = 5½. G. = 2.7.

San Diego County: **1**, Occurs as a pseudomorph after beryl; a cavity in the pseudomorph is lined with bavenite crystals, Schaller and Fairchild (48) p. 409. Bavenite is reported as occurring very sparingly in the Pala district, Jahns and Wright (5) p. 31. This is presumably the same locality reported by Schaller and Fairchild.

BAYLDONITE

Basic arsenate of copper and lead, $(Cu,Pb)_2(AsA_4)_4(OH)$ (?)

Monoclinic(?). Minute mammillary concretions with fibrous structure and drusy surface. Also massive and as crusts. H = 4½. G. = 5.5. Luster resinous. Color siskin green to apple green and yellow green. Subtransparent to transparent.

Easily fusible. In C. T. loses water and blackens. Soluble with difficulty in HCl.

San Bernardino County: **1**, Some thin crusts of a yellowish green mineral on limestone, associated with barite veins 1 mile southwest of Lead Mountain, suspected of being hedyphane, have been shown by X-ray study to be bayldonite, Murdoch and Webb (14) p. 327, Murdoch (p.c. 1954).

BECHILITE

Hydrous calcium borate, $CaO \cdot 2B_2O_3 \cdot 4H_2O$

Shasta County: **1**, An incrustation at Lick Springs, was called "borocalcite of Hayes," by J. B. Trask (7) p. 61. It may be bechilite, or perhaps ulexite.

BEIDELLITE

Hydrous aluminum silicate, $Al_8(Si_4O_{10})_3(OH)_{12} \cdot 12H_2O$

Orthorhombic? In thin crystal plates. One cleavage. Waxy to vitreous luster. Color white, reddish, or brownish gray. H. = 1½. G. = 2.6.

Infusible. Becomes plastic in water.

Los Angeles County: **1**, It occurs in graphitic schists with sillimanite in the upper part of Elizabeth Lake Canyon, near its junction with the San Andreas rift valley, as patches and fracture fillings in feldspar, Beverly (1) p. 352.

Sierra County: **1**, Occurs as gray, clayey, microscopically crystalline masses in cavities in veins in the Alleghany district, Ferguson and Gannett (6) p. 45.

BEMENTITE

Hydrous manganese silicate, $Mn_5Si_4O_{10}(OH)_6$

Orthorhombic. Fine fibrous masses and granular. Luster vitreous to pearly. Color pale grayish yellow to light brown. H. = 4-6. G. = 2.98.

Fuses easily to a dark-brown glass. Soluble in hydrochloric acid without gelatinization. Gives green bead of manganese with sodium carbonate.

"It is found with both rhodochrosite and rhodonite, and is in some deposits the main manganese mineral. This mineral varies in color from dark honey yellow to reddish brown to straw color. When coarsely crystalline it is bladed, but most California bementite is finely crystalline and has a waxy luster, which is characteristic, but which inexperienced persons may have difficulty recognizing. The best way to find bementite is to look for weathered fragments of a waxy yellow or brown rock that cannot be scratched with a knife and that grades outward into black oxide," P. D. Trask et al. (4) p. 70. It has been reported as one of the chief minerals in primary manganese ore from 19 counties in the State, ibid. p. 68, and the following specific localities are noted:

Alameda County: **1**, In the Arroyo Mocho manganese ore (N. R.). **2**, At the Bailey mine with inesite and gray rhodochrosite (N. R.).

Calaveras County: **1**, Occurs with rhodochrosite at the Big Little Bear (sec. 24, T. 3 N., R. 11 E., M. D.) and Kellogg (sec. 4, T. 2 N., R. 12 E., M. D.) properties, P. D. Trask et al. (4) p. 60.

Humboldt County: **1**, Occurs with brown neotocite and rhodochrosite, at the Woods mine, 12 miles north of Blocksburg (N. R.).

Mariposa County: **1**, Occurs with oxides and carbonates near Coulterville, P. D. Trask et al. (4) p. 80.

Mendocino County: **1**, Granular pale-brown bementite occurs with neotocite at the Thomas mine, 6 miles northeast of Redwood (N. R.). **2**, It was found with inesite and neotocite at the Mount Sanhedrin deposits, especially in the Rhodochrosite claim at Impassable Rock (N. R.).

Riverside County: **1**, Occurs at the Beal-McClellan (SW¼ sec. 23, T. 5 S., R. 4 W., S. B.) and Elsinore (same, secs. 23, 24) properties, P. D. Trask et al. (4) p. 83.

San Benito County: **1**, Found in manganiferous chert at the Hawkins mine (sec. 35, T. 11 S., R. 6 E., M. D.), P. D. Trask et al. (4) p. 83.

San Joaquin County: **1**, The old Ladd mine at Corral Hollow, (secs. 2, 11, T. 4 S., R. 4 E., M. D.), carries bementite and hausmannite, W. W. Bradley (32) p. 98.

Santa Clara County: **1**, Bementite occurs at the Jones (NW¼ sec. 27, T. 6 S., R. 5 E., M. D.) and other properties, mostly in the northeastern portion of the county, with rhodochrosite and oxides, P. D. Trask et al. (4) p. 87.

Stanislaus County: **1**, It is a constituent of the ore from the Cummings lease on the Winship property, where it occurs as granular masses, mixed with gray rhodocrosite and rose-red inesite (N. R.).

Trinity County: **1**, Bementite occurs at the Hale Creek mine (NW¼ sec. 23, T. 1 S., R. 1 E., H.) in Mad River Valley with inesite, P. D. Trask et al. (4) p. 59. **2**, At the Manganese Queen, Spider, and Lucky Bill properties (sec. 27, T. 30 N., R. 12 W., M. D.), ibid. p. 60. **3**, (sec. 9, T. 26 N., R. 11 W., M. D.) with rhodonite and rhodochrosite. ibid. p. 60.

Tuolumne County: **1**, Bementite occurs with rhodochrosite at the Hughes mine (sec. 17, T. 2 S., R. 15 E., M. D.), P. D. Trask et al. (4) p. 91.

* BENITOITE, 1907

Barium titano-silicate, $BaTiSi_3O_9$

Hexagonal; ditrigonal-bipyramidal. Trigonal pyramids with prisms. Vitreous luster. Colorless to deep blue. Transparent. H. = 6½. G. = 3.64-3.67.

Fusible. Gives the green flame of barium. Sufficiently soluble to give the titanium reaction when the hydrochloric acid solution is boiled with tin.

Kern County: **1**, Small grains of benitoite were found in the heavy grains from a drill-hole in the Lazard area, Lost Hills (southeast corner T. 27 S., R. 20 E., M. D.), with some piedmontite, dumortierite etc., Reed and Bailey (4) p. 363.

San Benito County: **1**, Colorless and sapphire-blue crystals of this mineral were discovered in 1907 near the headwaters of the San Benito River (sec. 25, T. 18 S., R. 12 E., M. D.). They were originally thought to be sapphire, but were found to be a new mineral and named by Louderback and Blasdale (2) p. 149, (5) p. 331. The crystals occur in a zone of narrow veins of natrolite in serpentine, and are associated with neptunite and joaquinite. The mineral represents the first natural occurrence of the trigonal class, hexagonal system, and has been studied and measured by various authors: A. F. Rogers (2) p. 616; Palache (6) p. 398; Hlawatsch (1) p. 178, (3) p. 602, (4) p. 293; Baumhauer (2) p. 592; Valeton (1) p. 92. **2**, A second locality for benitoite, close to the original discovery, has been reported, Mineral Notes and News (1) p. 3, Pabst (11), p. 479.

Analyses by Blasdale

SiO_2	TiO_2	BaO
43.56	20.18	36.34 = 100.08%
43.79	20.00	36.31 = 100.10%

BENTONITE

See montmorillonite

BERTHIERITE

Iron-antimony sulphide, $FeSb_2S_4$

Orthorhombic. Long prismatic. Usually fibrous massive. Metallic luster. Color dark steel gray. Streak grayish black. H. = 2-3. G. = 4-4.3.

A slight coating of white oxide of antimony and a slight odor of sulphur can be obtained by roasting on charcoal. The roasted mineral becomes magnetic.

Tuolumne County: **1**, A dark-colored ore from the southeast slope of Mount Gibbs may contain an impure berthierite with galena and other sulphides, Turner (12) p. 714. This is a rather dubious occurrence, and it is more than possible that it is not authentic.

BERTRANDITE

Silicate of beryllium, $H_2Be_4Si_2O_9$

Orthorhombic-hemimorphic. Small tabular or prismatic crystals, perfect prismatic cleavage. H. = 6-7. G. = 2.6. Colorless to pale yellow. A rare pegmatite mineral associated with beryl.

San Diego County: **1**, Tabular white to light-gray crystals of bertrandite are reported as very rarely occurring on Heriart and Chief Mountains, in the Pala pegmatites, Jahns and Wright (5) p. 31.

BERYL

Beryllium and aluminum silicate, $Be_3Al_2Si_6O_{18}$

Hexagonal. Prismatic crystals. Brittle. Vitreous luster. Color green, blue, rose, yellow. Streak white. H. = 7½-8. G. = 2.63-2.80.

Whitens and is very difficult to fuse, yielding an enamel. Insoluble in acid.

Aquamarine is a pale-blue to pale-green beryl. *Emerald* is a transparent green beryl. *Morganite* is pink.

Beryl is found as crystals, some of which attain a great size, in granite pegmatites. Synthetic emerald has been made in California, A. F. Rogers (49) p. 762.

Fresno County: **1**, It has been reported 5 miles northeast of Trimmer, (sec. 34, T. 11 S., R. 25 E., M. D.) with topaz, apparently in a pegmatite, W. W. Bradley (2) p. 438. **2**, It has been found in pegmatite just east of Academy. (T. 12 S., R. 22 E., M. D.), Noren, (p. c. '45).

Inyo County: **1**, Narrow veins with small crystals of opaque blue beryl are found cutting granite about 1½ miles southeast of Lone Pine Station, Webb and Murdoch (p. c. '45). This is probably the same locality reported by Sterrett (10) p. 312 as "in the desert between Barstow and Lone Pine," in pale to dark blue crystals up to half an inch in diameter. **2**, It has also been found with fluorite 3 miles west of Lone Pine, W. W. Bradley (23) p. 396, S. M. B. (20687).

Lassen County: **1**, Beryl is found with tourmaline and mica at the Mount Thompson gem mine (T. 28 N., R. 13 E., M. D.) north and east of Milford, Melhase (p. c. '40).

Riverside County: **1**, Yellow and pale-green beryl have been found at the Fano mine (NW¼SW¼ sec. 33, T. 6 S., R. 2 E., S. B.), on the north side of Coahuila Mountain, Kunz (24) p. 49, Fisher (1) p. 68, Tucker and Sampson (35) p. 165. **2**, The rose colored variety, morganite, was found near Hemet, Kunz (25) p. 942. **3**, Blue and green crystals up to half an inch in length occur in a small pegmatite just west of the Jensen quarry 4 miles west of Riverside, Clark (p. c. '36). **4**, A considerable quantity of blue-green beryl, some of gem quality, is found 2 miles east of Riverside on the Mears property at the base of Box Springs Mountain, Sterrett (3) p. 799.

San Diego County: Beryl, sometimes in large and beautiful crystals has been found in the most of the gem-pegmatite dikes of this county. **1**, A pale rose crystal (morganite) came from a pegmatite mine on Aguanga Mountain near Oak Grove (probably the Mountain Lily), and measured 11 by 7½ by 6½ centimeters, Kunz (24) p. 49. Pink beryl from here showed 1.60 percent cesium oxide on analysis, Clarke (10) p. 309. **2**, Morganite was found in the Katrina (Catherina) and other mines on Heriart Hill at Pala, Kunz (23) p. 942, (24) p. 81, (26) p. 1345. This beryl carried 0.57 percent of cesium oxide, Ford (6) p. 128. Jahns and Wright (5) p. 37. **3**, At Mesa Grande, the Himalaya and Esmeralda mines produced pink, golden, and aquamarine beryl, Kunz (24) p. 49. One group of pink beryl from the Esmeralda mine showed tabular crystals 1½ inches across, Kunz (26) p. 1340. **4**, At the Mack mine, Rincon (sec. 25, T. 10 S., R. 1 W., S. B.), there were pink and deep opaque blue beryls, Kunz (24) p. 49, and some clear, complexly etched crystals, Eakle (7) p. 89, A. F. Rogers (4) p. 212, Hanley (3) p. 14. **5**, At Ramona, in the A. B. C., Surprise, and other mines, variously colored beryl has been found, including morganite, Kunz (24) p. 49, Eakle (6)

p. 89. Ford (4) p. 217, has observed some remarkable etching on yellow crystals from this locality. **6**, Pink and green beryls associated with essonite garnets are reported from the Crystal mine 8½ miles northwest from Jacumba, Kunz (24) p. 49.

Trinity County: **1**, Pink crystals have been found in placer deposits near Hamburg, Smith (p. c. '36) S.M.B (20685), and identified by Sperisen and Melhase. **2**, Emerald-green crystals have come from J. Carr's mine, Coffee Creek district, S.M.B. (15550).

Tuolumne County: **1**, Several small green crystals, one doubly terminated, were found 3 or 4 miles from Jamestown, W. P. Blake (3) p. 84, Petar (1) p. 90.

BETAFITE

Hydrous oxide of uranium, calcium, columbium, tantalum, and titanium, $(U,Ca)(Cb,Ta,Ti)_3O_9 \cdot nH_2O$

Isometric, crystals usually octahedral. H. = 4-5.5. G. = 3.7-5. Luster waxy to vitreous to semi-metallic. Color greenish brown to yellow to black. Nearly opaque.

Strongly radioactive. Difficultly decomposed by acids.

San Bernardino County: **1**, Betafite occurs as small octahedral crystals, associated with cyrtolite, in a mass of dark minerals, mostly biotite and magnetite, in a pegmatite in the Cady Mountains, north of Hector, Hewett and Glass (3) p. 1048. The crystals, some of which are 6 mm in diameter, are partially altered, with a crust of an unidentified mineral.

BETA—ASCHARITE

See szaibelyite

BEYERITE

Carbonate of bismuth and calcium, $Ca(BiO)_2(CO_3)_2$

Tetragonal. Thin rectangular plates flattened parallel to the basal pinacoid. Compact earthy masses. Fracture conchoidal in crystals. H. = 2-3, G. = 6.56, but less in massive, porous material. Luster vitreous in crystals. Color bright yellow to lemon yellow; in massive material, yellowish white to grayish green and gray.

San Diego County: **1**, Compact masses of greenish-gray beyerite, as alteration product of an earlier bismuth mineral, were found in the Stewart mine, at Pala, Frondel (3) p. 533.

BIEBERITE

Hydrous cobalt sulphate, $CoSO_4 \cdot 7H_2O$

Monoclinic. Stalactites and crusts. Vitreous luster. Color flesh and rose red. H. = 2. G. = 2.

Gives a blue bead with borax. Sulphate is precipitated by barium chloride. Yields water in a closed tube and has an astringent taste.

Trinity County: **1**, Small amounts of bieberite as a pale rose-red powder, occur with other alteration products on pyrrhotite at the Island Mountain deposit, Landon (1) p. 279.

BINDHEIMITE

Pyroantimonate of lead, $Pb_2Sb_2O_6(O,OH)$

Isometric. As cryptocrystalline masses, dense to earthy; incrustations. Nodular and reniform masses with concentric layering; sometimes opaline. Pseudomorphous. Fracture earthy to conchoidal. H. = 4-4½. G. = 4.6-5.6. Luster resinous to dull or earthy. Color yellow, brown,

reddish brown, gray, white, greenish. Streak white to yellowish. Opaque to translucent.

Dissolves leaving a residue to antimonic oxide in HNO_3 and of lead chloride in HCl.

Bindheimite is very widely distributed in oxidized ores and is much more abundant than was commonly believed in antimonial ores of lead and silver, Shannon (1) p. 88.

Fresno County: **1**, Brown bindheimite has been described from this county, Larsen (11) p. 47, and a green opal-like specimen is in the University of California collections at Berkeley.

Inyo County: **1**, It is a common oxidation product in lead ores at the Cerro Gordo mine, Hanks (12) p. 71, A. Knopf (8) p. 114. **2**, Murphy (2) p. 322, has found it in the Panamint district.

San Bernardino County: **1**, Indistinctly fibrous material from this county, probably pseudomorphous after jamesonite, was analyzed by Shannon (1) p. 93. No detail of locality is given.

BIOTITE

Hydrous potassium, magnesium, iron, and aluminum silicate, $K(Mg,Fe'',Al)_3(Si,Al)_4O_{10}(O,OH)_2$.

Monoclinic. Tabular or short prismatic. In hexagonal plates. Foliated, scaly, micaceous. Cleavage perfect basal. Vitreous to pearly luster. Black, dark brown, green. Streak uncolored. H. = 2½-3. G. = 2.7-3.1.

Very difficult to fuse. Iron-rich varieties become magnetic on heating. Gives a little water in a closed tube. Decomposed by hydrochloric acid.

Biotite is the commonest of all the micas. It is a prominent constituent of many igneous rocks, and also of pegmatites, gneisses, and schists. It is present as a rock-forming mineral in every county. Only a few occurrences are of sufficient interest to record.

Riverside County: **1**, Large blade-like plates of biotite make a spectacular showing on the wall of the Southern Pacific silica quarry near Nuevo, Murdoch (p.c. '45.).

San Diego County: **1**, Occasionally large plates of biotite are found in the gem pegmatites at Pala, Schaller (p.c. '36). Some of the biotite from Pala shows cesium and rubidium on analysis, Stevens and Schaller (3) p. 528. **2**, Broad plates of biotite are present in the pegmatites at Rincon, A. F. Rogers (4) p. 216.

BISMITE

Bismuth ocher, Bi_2O_3.

Monoclinic. Massive; compact granular to earthy and pulverulent. H. = 4½ (or less in earthy material). G. = 8.64-9.22.

Luster sub-adamantine to dull. Color grayish green, greenish yellow to bright yellow. Streak grayish to yellow.

San Diego County: Bismite has been reported at Pala, Kunz (20) p. 398, but Schaller (25) p. 230 considers yellow material from the Stewart mine to have been a mixture of $BiVO_4$ and $Bi(OH)_2$, while the gray material is bismuth hydroxide, $Bi_2O_3.3H_2O$.

A yellow oxidation product of bismuth, at the Victor mine, Rincon, was described by A. F. Rogers (4) p. 208 as including some microscopic crystals. These crystals were shown by Frondel (3) p. 523 to be Bi_2O_3, or true bismite, although the presence of vanadium in the ocherous material here too, was shown by Schaller (25) p. 165, indicating the presence of pucherite, Palache et al. (10) p. 600.

BISMUTH

Native bismuth, Bi

Hexagonal-rhombohedral. Usually in arborescent-reticulated shapes. Brittle. Metallic. Color and streak silver white with reddish hue, tarnishing dark brown. H. = 2½. G. = 9.8.

Heated on charcoal, it gives a lemon-yellow coating. Mixed with a flux of potassium iodide and sulphur, and fused on charcoal, the coating is bright red, which distinguishes it from that of lead, which is yellow.

Crystals and veinlets of metallic bismuth sometimes accompany ores of bismuth, cobalt, silver, and gold. Bismuth is also occasionally found in pegmatitic veins.

Inyo County: **1**, Bismuth was found at Antelope Springs, Deep Spring Valley (N. R.). **2**, Doubtfully, at Big Pine Creek (N. R.).

Mono County: **1**, Possibly found at Oasis (N. R.).

Nevada County: **1**, A notable amount of bismuth was detected in the concentrates of the Providence mine, Nevada City district, Lindgren (12) p. 117.

Riverside County: **1**, It has been reported from veins southeast of Banning, Sanford and Stone (1) p. 25. Doubtful.

San Diego County: **1**, Long irregular crystals, sometimes capping tourmaline, have been found at the Stewart mine, Pala, Kunz (20) p. 398. **2**, Small bright cleavages occur in lepidolite at the Victor mine, Rincon, A. F. Rogers (4) p. 208. **3**, It has been reported from a locality near Jacumba, F. J. H. Merrill (1) p. 670.

Sierra County: **1**, A specimen in the Stanford University collections is from Slug Canyon.

BISMUTH-GOLD—Maldonite

Au_2Bi

Isometric. Massive, granular, and in thin coatings. Malleable and sectile. Luster metallic. Color pinkish silver white on fresh fracture, tarnishing copper red to black. H = 1½-2. G. = 15.46.

On charcoal easily fusible giving a white bismuth sublimate and leaving a gold button. Soluble in aqua regia.

El Dorado County: **1**, A natural alloy, 60 percent gold and 40 percent bismuth came from the Coon Hollow hydraulic mine near Placerville in 1899. S. M. B. (15391).

BISMUTHINITE

Bismuth sulphide, Bi_2S_3

Orthorhombic. Usually fibrous massive. Metallic. Color and streak lead gray. H. = 2. G. = 6.4-6.5.

Heated on charcoal, it gives a yellow coating and sulphur odor. Coating assumes a bright-red border when the mineral is fused with potassium iodide and sulphur.

Bismuth has frequently been detected in the concentrates from several of the gold and copper districts, but the form in which it occurs has not in general been determined. Bismuthinite as a distinct mineral has been noticed in only a few localities.

Fresno County: **1**, Some small pieces of bismuthinite were found at the Second Sierra and Lot One mines, in the Kings Creek district S. M. B. (12856, 12857). **2**, It is reported from about 20 miles north of Trimmer on the Kings River (N. R.).

Inyo County: **1**, A specimen has come from the Kearsarge Mountains, near Independence, S. M. B. (14253). **2**, It occurs with barite and

scheelite, in bismutite from the Fernando mine, Darwin district, L. K. Wilson (1) p. 553. **3**, Also with bismutite from the Tungsten Hills, west of Bishop, Woodhouse (p.c., '46). **4**, Occurs as ocherous masses in a prospect on the west side of Panamint Valley in the Argus Range, near mouth of Surprise Canyon. Alteration to oxides and carbonates is almost complete, Woodhouse (p.c. '54).

Kern County: **1**, It has been found in the Big Blue group of mines near Kernville (T. 25 S., R. 33 E., M. D.), Prout (1) p. 413.

Madera County: **1**, It is recorded by Turner (12) p. 714, as occurring in the Sierra gold and silver mine in the Minaret district.

Mono County: **1**, A specimen from Oasis, S. M. B. (11467), is bismuthinite with bismutite. **2**, A little bismuthinite occurs in quartz veins with brannerite, 7 miles south of Coleville, in the canyon of the West Walker River, Pabst (13) p. 109.

Riverside County: **1**, It is found at the Lost Horse mine (N. R.).

San Bernardino County: **1**, A few pounds of bismuthinite were found in the United Tungsten copper mine, in the Morongo district (sec. 27, T. 2 N., R. 3 E., S. B.), Hamilton and Root (5) p. 114, Newman (1) p. 241. **2**, It occurs in quartz at the Gold Eagle mine, Morongo district, Tucker and Sampson (17) p. 297.

San Diego County: **1**, A 5-pound mass was found at Pala, G. A. Waring (2) p. 363.

BISMUTH OCHER

See bismutite; bismutosphaerite

BISMUTITE

Bismuth carbonate, $(BiO)_2CO_3$

Incrusting fibrous, or earthy and pulverulent. Vitreous to dull luster. White, green, yellow and gray. Streak greenish gray. H. = 4. G. = 7.

Fused on charcoal with potassium iodide and sulphur, it gives a red coating. A small amount of water is obtained by heating in a closed tube. Effervesces in acid.

Bismutite is of secondary origin, being derived chiefly from the alteration of bismuthinite and native bismuth. Sometimes called bismuth ocher.

Bismutosphaerite, originally described as a separate species has been shown to be identical with bismutite, Frondel (3), p. 521.

Fresno County: **1**, Some small specimens of bismuthinite and bismutite came from the Second Sierra and Lot One mines in the Kings Creek district, S. M. B. (12856, 12857).

Inyo County: **1**, A little bismutite was found in the gold placers of Big Pine Creek, Hanks (12) p. 79. **2**, "Rich ores of bismuth, chiefly carbonate" come from Antelope Spring, on the northwest side of Deep Springs Valley, Goodyear (3) p. 236, Irelan (4) p. 46. **3**, Fibrous to crypto-crystalline specimens were found near Lone Pine, Larsen (11) p. 48. There is a specimen from this locality in the University of California collections at Berkeley. **4**, It occurs on bismuthinite at the Fernando mine, Darwin district, L. K. Wilson (1) p. 553. **5**, It has been found with tetradymite in a brecciated quartz vein in the Cerro Gordo district, Webb (2) p. 399. **6**, It occurs with bismuthinite from the Tungsten Hills west of Bishop, Woodhouse (p.c., '46).

Los Angeles County: **1**, White earthy bismutite from somewhere in this county is represented by S. M. B. (16343).

Mono County: **1**, It occurs with bismuthinite near Oasis, S. M. B. (11467).

San Bernardino County: **1**, Green needles of bismuth carbonate, up to $\frac{1}{8}$ by $\frac{3}{4}$ of an inch were found at the United Tungsten copper mine, in the Morongo district (sec. 27, T. 2 N., R. 3 E., S. B.), Hess and Larsen (17) p. 261. Tucker (4) p. 374.

San Diego County: **1**, Bismutite was found at Pala as an alteration product of bismuth, Schaller (5) p. 267. **2**, At the Victor mine, Rincon, it was found with bismite and pucherite, Sanford and Stone (1) p. 25, Palache et al. (10) p. 600.

BISMUTOSPHAERITE

See bismutite

BLACK JACK

See sphalerite

BLACK LEAD

See graphite

BLÖDITE

Hydrous magnesium and sodium sulphate, $MgSO_4 \cdot Na_2SO_4 \cdot 4H_2O$

Monoclinic. Prismatic crystals, granular massive. Vitreous luster. Colorless to greenish, yellowish, red. H. = 3. G. = 2.23.

Fuses, giving a strong yellow flame. Barium chloride precipitates barium sulphate from an acid solution. Magnesia is determined by precipitation with sodium phosphate from an ammonia solution. Easily soluble in water. Gives water in a closed tube.

Imperial County: **1**, A layer of blödite, 6 to 12 inches thick, occurs inter-stratified with thenardite and clay at the Bertram sodium sulphate deposits (N$\frac{1}{2}$ sec 19, S$\frac{1}{2}$ sec. 13, T. 9 S., R. 12 E., S. B.), R. J. Sampson and Tucker (18) p. 140.

San Luis Obispo County: **1**, Very large crystals were found in the mud of Soda Lake, Carrizo Plain (T. 31 S., R. 20 and 21 E., M. D.), H. S. Gale (10) p. 430. The crystals were described by Schaller (32) p. 148.

BLOODSTONE

See quartz, chalcedony

BLUE VITRIOL

See chalcanthite

BOEHMITE

Basic oxide of aluminum, $AlO(OH)$

Microscopic orthorhombic plates, with good cleavage in one direction.

Riverside County: **1**, Boehmite occurs at the Alberhill clay pits, associated with gibbsite, V. T. Allen (7) p. 1173.

* BOOTHITE, 1903

Hydrous cupric sulphate, $CuSO_4 \cdot 7H_2O$

Monoclinic. Fibrous, massive. Vitreous. Greenish blue. H. = 2-2½. G. = 1.94.

Same reactions as for chalcanthite.

Alameda County: **1**, Discovered as a new mineral with other sulphates of iron and copper at the Alma mine, Leona Heights, Schaller (1) p. 207. Purer material was analyzed by Schaller (8) p. 123.

CuO	FeO	MgO	SO_3	H_2O at 110°	H_2O above 110°	Insol.
26.13	0.81	0.64	27.25	36.76	4.91	3.96 = 100.46%

Calaveras County **1**, Massive material and crystals came from Campo Seco, Schaller (3) p. 192, (8) p. 122.

BORACITE

Magnesium borate with chlorine, $Mg_6Cl_2B_{14}O_{26}$

Isometric-tetrahedral. Crystals cubic and tetrahedral; massive. H. = 7. G. = 2.9-3.0. Color white, inclining to gray.

San Bernardino County **1**, Boracite has been reported from Otis, Wainewright (1) p. 158.

BORAX

Hydrous sodium borate, $Na_2B_4O_7 \cdot 10H_2O$

Monoclinic. Crystals prismatic. Powder, incrustations. One cleavage perfect. Vitreous to dull luster. Colorless, white, grayish, bluish. Streak white. H. = 2-2½. G. = 1.69-1.72.

Fuses with strong yellow flame to a clear glass. Turmeric paper dipped in a hydrochloric acid solution turns deep red on drying. Soluble in water. Gives much water in a closed tube. Sweetish alkaline taste. Changes rapidly on exposure to white powdery tincalconite.

The mineral borax, usually accompanied by sulphates of lime and soda, is common at many of the depressions or sinks of the deserts.

Inyo County: **1**, It occurs in many of the playas of the Death Valley area at and near Furnace Creek. **2**, Resting Springs (T. 21 N., R. 6 and 8 E., S. B.). **3**, Tecopa (approximately T. 20 N., R. 9 E., S. B.), G. E. Bailey (2) pp. 48, 49, Hanks (11) pp. 36, 37. **4**, It also is found at Ash Meadows, close to the Nevada line in the southwest corner of the county, Yale (2) p. 1022. **5**, To the north, it was found in Saline Valley, in 1874, as a borax crust 6 to 24 inches in thickness, Fleming (1) p. 248, Waring and Huguenin (2) p. 62. **6**, Near Fish Slough, in the Bishop Creek area (T. 6 S., R. 33 E., M. D.), 5 to 6 miles from the bridge across the Owens River, Engineering and Mining Journal (5) p. 183. **7**, Some of the muds near Big Pine were reported to carry borax crystals, Yale (2) p. 1023.

Kern County: **1**, Abundant and valuable deposits of massive borax, in layers up to 10 feet in thickness, are found in the Suckow mine at Kramer, and in the mines of the Pacific Coast and Western Borax Companies, associated with colemanite, ulexite, probertite (kramerite), etc., and occasional particles of realgar, Schaller (45) p. 164. **2**, At Indian Springs, which is probably the same as Indian Wells (T. 26 S., R. 38 E., M. D.), described as "near Walker's Pass," borax has been found in the playa, G. E. Bailey (2) p. 50, Silliman (12) p. 130. 3, It is reported from Rodriquez Lake (Rogers Lake, or Muroc Lake) in the southeast corner of the county, Yale and Gale (4) p. 840. 4, Also in China Lake (T. 25 S., R. 40 and 41 E., M. D.) partly in San Bernardino County, G. E. Bailey (2) p. 50.

Lake County: **1**, Although the first published record of borax in California was from Borax Lake in 1865, as crystals in the lake muds,

Harris (1) p. 450, the compound was detected in the waters of Tuscan Spring in Tehama County, near the mouth of the Pit River, and in the waters of Borax Lake, as early as 1856, by Dr. John A. Veatch, reported by him in a letter to the Borax Company of California dated June 28, 1857, and quoted in J. R. Browne and Taylor (1) p. 179. Here he states that in March, 1857 he had found crystals of borax in the underlying muds of the lake bed, ibid., p. 184. **2,** Abundant borax was also found, in solution in the waters of Lake Hachinhama, 4 miles west of Borax Lake, G. E. Bailey (2) p. 52.

San Bernardino County: **1,** A very important source of borax is the basin of Searles Lake, where the mineral is found as an efflorescence on the surface, and in large crystals in drill cores, associated with many unusual saline minerals, H. S. Gale (13) p. 285. **2,** It has also been detected at Soda Lake, in the sink of the Mojave River (T. 11, 12, and 13 N., R. 8 and 9 W., S. B.), G. E. Bailey (2) p. 62. **3,** A little occurs in the playa of Palma Lake 6 miles from 29 Palms (secs. 5, 6, 29, 31, 32, T. 22 N., R. 9 E., S. B.), G. E. Bailey (2) p. 62. **4,** It was found at Borate, in the Calico Hills, G. E. Bailey (2) p. 56.

Siskiyou County: **1,** It occurs as an efflorescence, and also in solution, at Antelope Creek in the upper Sacramento Valley (T. 44 N., R. 1 W., M. D., approximate), J. B. Trask (7) p. 22.

BORNITE—Erubescite—Peacock Ore

A sulphide of copper and iron, Cu_5FeS_4

Isometric. Crystals very rare. Generally compact massive. Metallic luster. Color reddish brown, generally tarnished to iridescent colors. Streak grayish black. H. = 3. G. = 4.9-5.4.

Reduced on charcoal with sodium carbonate, it yields globules of metallic copper and a magnetic residue. Dissolved in nitric acid and ammonia added, much ferric hydrate is precipitated, while the solution becomes blue.

Bornite is not so widespread as chalcopyrite, but does occur abundantly in some copper ores, and in minor amounts in many localities.

Calaveras County: **1,** It is found in small amounts in the ores at Copperopolis and Campo Seco, Hanks (12) p. 94.

Contra Costa County: **1,** A little occurs with chalcopyrite and gold in Mitchell Canyon, Mount Diablo, Turner (1) p. 391.

Del Norte County: **1,** Occurs sparingly in the mines at the head of Copper Creek, Laizure (3) p. 288, Maxson (1) p. 148. **2,** With enargite at French Hill (N.R.)

El Dorado County: **1,** In the old Cosumnes mine, near Fairplay (sec. 25, T. 9. N., R. 12 E., M.D.) massive bornite occurred with molybdenite in a coarse pegmatite, Aubury (1) p. 180. **2,** Small amounts were found at the Alabaster Cave mine, near Pilot Hill, Aubury (4) p. 211, **3,** A specimen S.M.B. (7470) from the Boston mine at Latrobe, shows bornite pseudomorphous after picrolite. **4,** Small flakes of bornite occur scattered through serpentine near Shingle Springs, C. Y. Knight (1) p. 242. **5,** Small amounts of bornite are found at the Pioneer (Lilyama Extension) mine, Aubury (4) p. 213. **6,** The Voss (Camel Back) mine, (sec. 11, T. 11 N., R. 8 E., M. D.), ibid. p. 407. **7,** 4½ miles west of Placerville (sec. 15, T. 10 N., R. 10 E., M. D.), Mining and Scientific Press (42) p. 840.

Fresno County: **1**, It occurs with magnetite and free gold in the Uncle Sam mine, on the Kings River opposite Tehipite Dome, Hanks (12) p. 94, W. W. Bradley (2) p. 438.

Humboldt County: **1**, Bornite with native copper was recorded as float at the Red Cap Creek mine (sec. 29, T. 10 N., R. 6 E., H.), Crawford (1) p. 66. **2**, It occurs in schist at the Horse Mountain mine (secs. 33, 34, T. 6 N., R. 4 E., H.), Laizure (3) p. 306.

Inyo County: **1**, It is found sparingly in the mines of the Ubehebe group, Aubury (1) p. 245. **2**, Minor amounts are associated with other sulphides at the Bishop Creek mine, Schroter (2) p. 53. **3**, Bornite occurs with tetrahedrite at the Ashford (Golden Treasure) mine west of Shoshone on the east side of Death Valley, Tucker and Sampson (25) p. 383. **4**, Some was reported from the New Discovery mine (T. 20 S., R. 44 E., M. D.), in the Panamint Range, ibid. p. 413. **5**, Minor amounts of bornite occur in the Pine Creek tungsten mine, Bateman (1) p. 238.

Kern County: A little bornite was found with other sulphides at the following properties: Greenback, Woody district, Storms (13) p. 635; Exposed Treasure, Mojave district, Simpson (1) p. 409; Yellow Treasure, and in the Rademacher district, 5½ miles north of Searles, Tucker and Sampson (21) p. 339.

Lake County: **1**, A little bornite has been found at the T. B. M. prospect, (sec. 16, T. 12 N., R. 9 W., M. D.), L. L. Root (2) p. 85.

Los Angeles County: **1**, Occurs with molybdenite, etc., in the Winter Creek group (T. 1 N., R. 11 W., S. B.) on Santa Anita Creek, R. J. Sampson (10) p. 176. **2**, It was reported with fine garnet crystals from the Meadow Valley district (N. R.).

Madera County: **1**, A little bornite occurs in the Minaret district, Erwin (1) p. 70.

Mariposa County: **1**, Found sparingly in Cowan and Victoria mines, Hershey (5) p. 592.

Mendocino County: **1**, Considerable bornite was found with lawsonite, etc., in a road cut on the new Covelo road, Vonsen (p.c., '36).

Mono County: **1**, Minor amounts of bornite occur in the Tioga, Benton, Lake, and Sweetwater districts, Whiting (1) pp. 373, 374, 378.

Nevada County: **1**, A little bornite occurs with chalcocite and covellite in the Mineral Hill district, Dry Creek (T. 15 N., R. 6 E., M. D.), Forstner (4) p. 745. **2**, Minor amounts are found at the Great Eastern (California) mine (T. 18 N., R. 13 E., M. D.) in the Meadow Lake district, Logan (7) p. 359.

Plumas County: **1**, Important amounts of bornite, some forming a microscopic "graphic intergrowth" with chalcocite, are present in the ore of the Engels and Superior mines, Diller (9) p. 47, Turner and Rogers (32) p. 377, A. F. Rogers (17) p. 587. **2**, A narrow vein of massive bornite was found on A. J. Ford's claim, in Lights Canyon, Hanks (12) p. 94. **3**, Minor amounts of bornite occur at a number of other localities in the county: Bornite occurs near Portola (N. R.); at Surprise Creek, etc. (T. 24, 27 N., R. 10 to 12 E., M. D.), Hanks (12) p. 94, Logan (4) p. 462.

Riverside County: **1**, Bornite is one of the many minor minerals at Crestmore, Eakle (15) p. 352.

San Bernardino County: Small occurrences of bornite are widely distributed through the county. The following districts are represented:

1, Calico, Weeks (4) p. 534; **2**, Lava Beds, Storms (4) p. 356; **3**, Ord Mountain, **4**, Monumental, and **5**, Ivanpah Range, Tucker and Sampson (17) pp. 275, 277, 267; **6**, Signal, and **7**, Oro Grande, Cloudman et al., (1) pp. 785, 878; **8**, Dale, Tucker and Sampson (27) p. 79; **9**, Fremont, L. L. Root (2) p. 172; **10**, Wright et al. (5), p. 62.

Santa Clara County: **1**, Hanks (12) p. 94 reports bornite from near Lexington.

Shasta County: **1**, A little bornite has been found in the Bully Hill, Afterthought, and other mines of the county, Diller (10) p. 12, Tucker (9) p. 426.

Siskiyou County: **1**, Some bornite was found at the Richie mine on Boulder Creek, 3½ miles southwest of Callahan, Crawford (2) p. 64. **2**, Bornite occurs with minor amounts of covellite and some chalcopyrite at the Preston Peak mine (sec. 22, T. 17 N., R. 5 E., H.), J. C. O'Brien (4) p. 428.

Trinity County: **1**, Some bornite occurs in the pyrrhotite body at Island Mountain (N. R.).

Tulare County: Several small occurrences of bornite are noted in the county: **1**, Hart prospect (sec. 2, T. 15 S., R. 28 E., M. D.), Franke (1) p. 435; **2**, Powell copper (sec. 30, T. 19 S., R. 31 E., M. D.), Tucker (3) p. 909; **3**, Round Valley, 2½ miles east of Lindsay, ibid. p. 910; **4**, Oakland mine, Copper Canyon, 12 miles north of Mineral King, ibid. p. 910.

Tuolumne County: **1**, Bornite occurs with cinnabar on the slope of the ridge east of Horseshoe Bend, Turner and Ransome (15) p. 7. **2**, Bornite occurs with other sulphides in the lower levels of the Oak Hill mine, sec. 30, T. 2 S., R. 14 E., M. D., Logan (23) p. 54.

BORT

See diamond

BOTRYOGEN

Hydrous iron and magnesium sulphate, $Fe_2O_3 \cdot 2MgO \cdot 4SO_3 \cdot 15H_2O$

Monoclinic. Very small crystals. Reniform and botryoidal. One perfect cleavage. Vitreous luster. Color brick red, hyacinth red, ocher yellow. H. = 2-2½. G. = 2.04-2.14.

Fusible. Becomes magnetic on heating. Presence of magnesia distinguishes it from other iron sulphates. Partly soluble in water. Soluble in acid.

Napa County: **1**, Minute aggregates of small bright-red crystals with copiapite, were discovered at the Redington mine, and described by Eakle (3) p. 231 as a new mineral, "palacheite." He later established its identity as crystallized botryogen, Eakle (4) p. 379. **2**, Hulin (p.c., '36) found it also at the Palisades mine, 2 miles north of Calistoga.

BOULANGERITE

Lead antimony sulphide, $Pb_5Sb_4S_{11}$

Monoclinic. Prismatic or tabular crystals; plumose masses, granular. Cleavage good. H. = 2.5-3. G. = 5.7-6.3. Luster metallic. Color bluish lead gray. Streak red brown.

Inyo County: **1**, What has been tentatively identified as boulangerite from the Defiance mine, Darwin district, is represented by a specimen in the University of California collections at Berkeley.

Mono County: **1**, It is found as slender prismatic crystals, with wollastonite and idocrase, in a crystalline limestone on the property of Elias Bushati, (sec. 13, T. 1 N., R. 25 E., M. D.), on the north side of Leevining Canyon, Milton (p.c., '44).

BOURNONITE

A lead, copper, antimony sulphide, $PbCuSbS_3$

Orthorhombic. Short prismatic and tabular crystals; massive. Metallic luster. Color and streak lead gray. H. = 2½-3. G. = 5.7-5.9.

Fuses easily and on charcoal gives a white coating, at first of antimony oxide, followed by a yellow coating of lead oxide nearer the assay. Dissolved in nitric acid and ammonia added, the solution turns blue; soluble in hydrochloric acid with odor of hydrogen sulphide.

Butte County: **1**, Bournonite is reported with native antimony at the Surcease mine T. 21 N., R. 4 E., M. D., O'Brien (6) p. 431.

Inyo County: **1**, Massive bournonite was found at Cerro Gordo, in the Inyo Range, Reid (2) p. 81.

Kern County: **1**, A mineral doubtfully identified as bournonite has been found in the Mojave district, Schroter (1) p. 187. The finder suggests this might be jamesonite rather than bournonite.

BOUSSINGAULTITE

Hydrous ammonium and magnesium sulphate, $(NH_4)_2SO_4 \cdot MgSO_4 \cdot 6H_2O$

Monoclinic. Fibers, crusts, vermiform aggregates and stalactites. Cleavages one perfect, another distinct. Silky luster. Color pure white. H. = 2. G. = 1.68-1.72.

Easily fusible, and easily soluble in water. Barium chloride precipitates barium sulphate, and sodium phosphate precipitates the magnesia. Gives water in a closed tube. Heated in closed tube with lime, it gives odor of ammonia. Tastes saline-astringent.

Sonoma County: **1**, Abundant among the sulphate minerals as crusts and stalactites at The Geysers near Cloverdale, Goldsmith (7) p. 264, Day and Allen (2) p. 45, Vonsen (6) p. 289.

Ventura County: **1**, It was found at South Mountain coating crevices of sandstones and shales; formed by the escape of heated gases, Larsen and Shannon (9) p. 127.

BOYDITE

See probertite

BRANNERITE

A rare earth oxide $(U,Ca,Fe,Y,Th)_3Ti_5O_{16}$(?)

Orthorhombic(?) slender prisms. Black with dark greenish-brown streak. H. = 4½. G. = 4.5-5.45.

Radioactive. Decomposed by hot concentrated H_2SO_4.

Mono County: **1**, A few grains of this mineral have been found distributed in quartz veins, on the border of secs. 4 and 9, T. 7 N., R. 23 E., M. D., 7 miles south of Coleville, in the canyon of the West Walker River, Pabst (13) p. 109. The mineral occurs as slender prismatic crystals up to 10 cm in length, solidly embedded in quartz.

BRAUNITE

$3Mn_2O_3,MnSiO_3$

Tetragonal. Small pyramids and massive. Cleavage, pyramidal perfect. Brittle. Submetallic luster. Color and streak brownish black. H. = 6-6½. G. = 4.75.

B.B. Infusible. Soluble in hydrochloric acid and leaves a residue of silica. Gives all the reactions for manganese similar to hausmannite.

This mineral is probably rather widespread in the siliceous manganese ores of the State. It has been recognized from the following localities:

Humboldt County: **1**, It forms the primary ore mineral at the Fort Seward mine (sec. 15, T. 3 S., R. 4 E., H.), P. D. Trask et al. (4) p. 59.

Plumas County: **1**, It has been found in the Braito mine (sec. 27, T. 26 N., R. 9 E., M. D.), P. D. Trask et al. (4) p. 71.

Santa Clara County: **1**, Braunite was identified by x-ray study of "psilomelane" from Santa Clara, Ramsdell (1) p. 147.

Stanislaus County: **1**, A specimen from the Buckeye mine (secs. 2, 3, T. 5 S., R. 5 E., M. D.) was studied by Fleischer and Richmond (1) p. 283.

Trinity County: **1**, Vonsen (p. c. '45) reported braunite with rhodochrosite from the Shellview mine (sec. 17, T. 4 S., R. 6 E., H.).

BREWSTERITE

$(Sr,Ba,Ca)O \cdot Al_2O_3 \cdot 6SiO_2 \cdot 5H_2O$

Monoclinic. Prismatic crystals. One perfect cleavage. H. = 5. G. = 2.45. Color white. Easily fusible.

Mendocino County: **1**, It was found with edingtonite on Ash Creek, 1 mile northeast of the highway. The locality is not certain, and may be in Sonoma County, Vonsen (p. c., '45).

BRITTLE MICA

See margarite

BRITTLE SILVER ORE

See stephanite

BROCHANTITE

Basic sulphate of copper, $CuSO_4 \cdot 3Cu(OH)_2$

Orthorhombic. Small prismatic acicular crystals and drusy crusts. One cleavage perfect. Vitreous luster. Color emerald green, dark green. Streak pale green. H. = 3½-4. G. = 3.9.

Easily fusible. Reduced on charcoal with sodium carbonate, yields metallic copper. Barium chloride precipitates barium sulphate from a hydrochloric acid solution. Ammonia added to solution gives a blue color. Gives water in a closed tube.

Calaveras County: **1**, Brochantite was found as druses of small dark-green crystals at Copperopolis, A. F. Rogers (7) p. 376.

Inyo County: **1**, It occurs with caledonite and linarite at the Cerro Gordo mine, Eakle (9) p. 228. **2**, Bottle-green, radial crystals in brown jasper and chrysocolla were found near the headwaters of Cottonwood Creek in the Panamint Mountains, Ball (2) p. 211.

Plumas County: **1**, Crystals have been reported from the Engels mine (N. R.).

San Bernardino County: **1**, It was observed as coatings on breccia at Stagg (N. R.). **2**, Brochantite occurs in oxidized ores with linarite at a prospect in the Soda Lake Mountains near Baker, Murdoch (p.c. '49). **3**, Small crystals and crusts found in veins with chrysocolla 2 miles southwest of the Sidewinder mine, Bowen (1) p. 123.

BROMLITE—Alstonite

Carbonate of barium and calcium, $(Ba,Ca)CO_3$

Orthorhombic. In pseudo-hexagonal pyramids.

Mariposa County: **1**, Alstonite reported from the sanbornite locality near Incline, may be witherite, A. F. Rogers (39) p. 171.

BROMYRITE

Silver bromide, AgBr

Isometric. Color bright yellow to amber yellow; slightly greenish. G. = 5.8-6.

Kern County: **1**, Bromyrite was reported as abundant in the Karma vein, at Soledad Mountain, near Mojave, but this occurrence is dubious, Bateson (1) p. 173.

BRONZITE

See pyroxene, enstatite

BROOKITE

Titanium dioxide, TiO_2

Orthorhombic. Crystals tabular or pyramidal. Brittle. Adamantine luster. Color reddish brown to black. Streak uncolored to grayish. H. = 5½-6. G. = 3.87-4.01.

Reactions the same as for rutile. Distinguished by form.

El Dorado County: **1**, Small tabular crystals associated with anatase, occur on quartz, at Placerville, Kunz (5) p. 329, (15) p. 394, (24) p. 106.

Kern County: **1**, Minute spearlike crystals of brookite have been found in cavities of lava cast of the highway in Red Rock Canyon, J. Murdoch (p.c. '47).

BROWN HEMATITE

See limonite

BRUCITE

Magnesium hydroxide, $Mg(OH)_2$

Hexagonal-rhombohedral. Crystals usually broad tabular. Foliated plates and fibrous masses. Cleavage perfect basal. Sectile. Pearly luster. Color white, gray, pink, blue, green. H = 2½. G. = 2.38-2.4.

B.B. infusible. Yields a small amount of water in a closed tube. Easily soluble in dilute hydrochloric acid, and magnesium is precipitated by sodium phosphate. Gives a pink color characteristic of magnesia when intensely heated with cobalt nitrate.

Fresno County: **1**, In irregular masses and rounded pellets in contact metamorphic limestone in the Twin Lakes region, Chesterman (1) p. 272.

Riverside County: **1**, It is a product of alteration of periclase in the predazzite rock at Crestmore, Eakle (15) pp. 327, 332, A. F. Rogers (31) p. 463. **2**, It was found similarly in the new city quarry, 2 miles south of Riverside, Richmond (1) p. 725. **3**, A. F. Rogers (19) p. 581

reports brucite as alteration of periclase, at the old city quarry at North Hill, Riverside. **4**, Brucite, pseudomorphous after periclase, is abundant at the Jensen quarry, Murdoch (p.c. '47).

San Bernardino County: **1**, Brucite altering to hydromagnesite is found in marbles in Lucerne Valley (SE¼ SE¼ sec. 15, T. 6 N., R. 1 W., S. B.), Ian Campbell (1), p. 3.

San Francisco County: **1**, Brucite and xonotlite in serpentine, were found in cuts made by the Western Pacific Railroad on Army Street, San Francisco, Pabst (p.c., '44). **2**, Fibrous brucite in fine stellated white crystals is reported from the serpentines of the San Francisco peninsula, Gibbs, quoted in Mining and Scientific Press (19) p. 28.

BULTFONTEINITE

Basic calcium fluorine silicate, $2Ca(OH,F)_2 \cdot SiO_2$

Triclinic. Crystals are colorless to pink. Basal and side pinacoidal cleavages fairly good. H. = 4.5. G. = 2.73. Occurs in radiating spherulites and groups of small radiating acicular crystals.

Difficultly fusible.

Riverside County: **1**, Minute grains of bultfonteinite have been found as sugary streaks in veins of massive afwillite and scawtite on the 910 level of the Commercial quarry, Crestmore, Murdoch (30) p. 1347.

* BURKEITE, 1935

$2Na_2SO_4 \cdot Na_2CO_3$

Orthorhombic. Tabular crystals, twins. No cleavage. Brittle. Luster vitreous. Colorless. H. = 3½. G. = 2.57.

Easily fusible. Soluble in water.

San Bernardino County: **1**, Cross-shaped crystals of this new mineral, up to 4 millimeters in diameter, were found at a depth of 115 to 130 feet in well G 75, at Searles Lake, and described and named by Foshag (21) p. 50.

Analysis

Na_2O	K_2O	SO_3	CO_2	Cl	H_2O	Insol.
47.89	none	39.96	11.72	0.09	0.04	0.04 = 99.74%

BYTOWNITE

See feldspar

CAIRNGORM

See quartz

CALAMINE

See hemimorphite

* CALAVERITE, 1868

Gold telluride, $AuTe_2$

Monoclinic. Crystals with striated faces; also massive granular. Brittle. Metallic luster. Color pale bronze yellow to yellowish silver gray. Streak yellowish gray. H. = 2½. G. = 9.04.

Similar to sylvanite in its reactions.

Calaveras County: **1**, Calaverite was discovered at the old Stanislaus mine on Carson Hill, analyzed and named by Genth (5) p. 314. **2**, Also found in the Melones mine, ibid. p. 314. **3**, At the Morgan mine on Carson Hill, with sylvanite and petzite, ibid. p. 314. **4**, It occurs with

altaite, petzite, etc., at the Frenchwood mine, Robinsons Ferry (sec. 28, T. 2 N., R. 13 E., M. D.), Hanks (12) p. 68.

Analysis

Au	Ag	Te
40.70	3.52	55.89 = 100.11 percent

El Dorado County: **1**, Calaverite was reported from the Darling mine near Rock Creek, about 3 miles northeast of American Flat, Palache et al. (10) p. 336.

Siskiyou County: **1**, It was doubtfully reported with gold and petzite from the northern part of the county (N. R.).

Tuolumne County: **1**, It occurred at the Golden Rule mine, Hanks (12) p. 104.

CALCIOVOLBORTHITE

Copper calcium vanadate, $(Cu,Ca)_3V_2O_8 \cdot (Cu,Ca)(OH)_2$

Monoclinic (?) Rosettes and hexagonal scales. Color yellow green. Luster pearly. H. = 3½. G. = 3.5-3.9.

San Bernardino County: **1**, It has been reported to occur at Camp Signal, near Goffs, Schrader et al. (1) p. 46.

CALCITE

Calcium carbonate, $CaCO_3$

Hexagonal-rhombohedral; scalenohedral. Crystals common, rhombohedrons and scalenohedrous. Also massive, fibrous, granular, stalactitic, chalky. Cleavage perfect rhombohedral. Vitreous luster. Colorless, white, gray, red, green, blue, yellow, brown, black. Streak white or grayish. H. = 3. G. = 2.71.

B.B. infusible. The carbonates are all characterized by their effervescence with hydrochloric or nitric acids. Calcite effervesces freely in cold dilute acid and gives a flame test that is bright red at first, fading into a yellow red. The calcium can be precipitated by ammonium oxalate as a white granular calcium oxalate.

The perfectly colorless, transparent form is called *iceland spar.*

Calcite is so widespread as limestone, and in veins, or spring deposits, that only the most important or interesting occurrences are listed. For commercial occurrences of limestone and marble, the reader is referred to Bulletin 38 of the California State Mining Bureau, Forstner et al. (3).

Alameda County: **1**, Pseudomorphs after aragonite are found near Patterson Pass, east of Livermore, A. F. Rogers (3) p. 18. **2**, A fine grade of lithographic limestone occurs on the Crocker-Winship properties, south of Danville (N. R.).

Alpine County: **1**, Fine groups of calcite rhombohedrons have come from the Pennsylvania mine (N. R.).

Calaveras County: **1**, Fine stalactites occur in Mercers Cave, 1¼ miles northwest of Murphy (N. R.).

El Dorado County: **1**, Fine stalactites occur at the Alabaster Cave (N. R.). **2**, Good crystals were found at the Cosumnes mine (N. R.).

Fresno County: **1**, Veins of fluorescent calcite with cinnabar, were found on Avenal Creek, Melhase (4) p. 38.

Imperial County: **1**, Calcite occurs as inverted "stalactites" originally identified as aragonite, in the area surrounding the mud volcanos near Niland, Hanks (9) p. 232.

Inyo County: **1,** Good iceland spar has been found in the Darwin district, Hanks (12) p. 114, S. M. B., (3709). **2,** Blue calcite with idocrase has been sent to the State Mining Bureau, reportedly from the North Fork of Shepard Creek, half a mile north of the Crystal Dome mine (T. 22 S., R. 42, 43 E., M. D.), W. W. Bradley (26) p. 195. This locality is questionable, but the material does not look like that from Crestmore. **3,** Fine crystals and stalactites have come from the Cerro Gordo and Union mines, and from the Lane mine (N. R.).

Kern County: **1,** "Sand calcite" crystals are found just north of Ricardo, at the junction of the highway and the Dove Springs road, Murdoch and Webb (11) p. 551. **2,** Fluorescent calcite is reported at the Hercules mine, in the Randsburg district, The Mineralogist, (2) p. 23. **3,** Blue rhombohedrons occur in Grizzly Canyon, 3 miles southwest of Tehachapi (N. R.).

Los Angeles County: **1,** Well-formed crystals occur in the borate deposit in Tick Canyon, Eakle (10) p. 189. **2,** Rhombohedral crystals are found in veins in Franklin Canyon, Funk (1) p. 33. **3,** At the Small Hill mine, on Santa Catalina island, S. M. B. (4069). **4,** Crystal-lined vugs are found in dikes of limestone and breccia half a mile north of Vicente Point, San Pedro Hills, Macdonald (2) p. 331.

Madera County: **1,** Abundant crystals come from the Kaiser Mountain district, 1½ miles from Huntington Lake road, Laizure (2) p. 102.

Marin County: **1,** Flat, thin-edged rhombohedrons of manganocalcite occur in a trachyte on the Burdell ranch. They turn black on weathering or on being heated (N. R.).

Merced County: **1,** Strontianocalcite is reported from Delhi, S. M. B. (16326).

Modoc County: **1,** Optical quality iceland spar in masses up to 60 or 80 pounds occurred in veins in basalt near Cedarville in the Warner Range. This deposit produced some commercial material but is now worked out, Hughes (1) p. 6.

Mono County: **1,** Pseudomorphs of calcite, called "thinolite," after original steep tetragonal pyramids of an unknown mineral, have been found about Mono Lake, E. S. Dana (1) p. 19, I. C. Russell (1) pp. 315, 316. These pseudomorphs are frequently formed of imbricated groups of pyramids, packed one within the other to make prismatic forms up to 8 or 10 inches in length. **2,** Large lenses or druses of iceland spar, some of optical quality, showing cleavage fragments up to 1 foot, occur in the upper Convict Basin, near Mammoth Lakes, Mayo (4) p. 84.

Monterey County: **1,** "Sand-calcite" crystals have been described by A. F. Rogers and Reed (28) p. 23, from the Cholame Hills (sec. 14, T. 23 S., R. 13 E., M. D.). In these the proportions are 65 percent sand, 35 percent calcite. **2,** Large perfect crystals have been reported from near Soledad (N. R.).

Nevada County: **1,** Fine scalenohedrons (dog-tooth spar) have come from the Pittsburg mine (N. R.). **2,** Crystals are associated with kämmererite at the Red Ledge mine near Washington (N. R.).

Riverside County: **1,** Coarsely crystalline blue calcite is very abundant at Crestmore, Eakle (15) p. 334. The blue color of calcite at Crestmore is discussed by Rosenholtz and Smith (1), p. 1049. **2,** Iceland spar occurs with fluorite and clear quartz at the Fluorspar group, 1 mile southwest of Packards Well, Palen Mountains, Aubury (1) p. 258.

San Bernardino County: **1**, Minute, ivory-colored crystals were found in well G 75 at Searles Lake, at a depth of 125 to 130 feet, associated with pirssonite, burkeite etc., Foshag (21) p. 51. **2**, Nodular concretions with radiating structure are found in a clay shale half a mile north of Mojave Water Camp, east of Daggett, Rocks and Minerals (1) p. 140, Murdoch and Webb (11) p. 551. **3**, Iceland spar is found in the Cave Canyon district (N. R.).

San Diego County: **1**, At the mine of Calcite Operators, Inc., (sec. 14, T. 10 S., R. 8 E., S. B.), broad flat plates of calcite, up to one foot across, and of optical quality, have been mined for gun-sights, Bramlette (p. c., '43), Durrell (p. c. '44).

San Francisco County: **1**, Calcite showing uncommon faces, in crystals up to several centimeters in size, came from Fort Point, San Francisco, Schaller (17) p. 103. They were associated with pectolite, datolite, and gyrolite.

Santa Cruz County: **1**, Well-developed calcite crystals have been found in the Vicente Creek tunnel near Davenport (N. R.).

Shasta County: **1**, Stalactitic and tubular forms have been found in Potters Cave, near Baird, Eakle (7) p. 89. **2**, Fossil pearls, altered from the original aragonite, occur along the north side of the road in Oak Run Valley, near the contact of the Chico and Ione formations, R. D. Russell (1) p. 419.

Tulare County: **1**, Massive blue crystalline calcite, associated with scheelite, has been reported from the Consolidated tungsten mine, Drum Valley, C. Knowlton (p.c. '46).

Tuolumne County: **1**, Calcite showing scarlet triboluminescense occurs near Columbia, Melhase (4) p. 38. **2**, Fine crystals were found at the Keltz mine (N. R.).

CALEDONITE

Basic sulphate of lead and copper, $(Pb,Cu)SO_4 \cdot (Pb,Cu)(OH)_2$

Orthorhombic. Small prismatic crystals. Cleavage perfect basal. Resinous to vitreous luster. Color bluish green and dark emerald green. H. = 2½-3. G. = 6.4.

Easily fusible. Fused on charcoal with sodium carbonate, it becomes reduced to metallic lead globules and coats the coal yellow near the assay. Barium chloride added to the hydrochloric-acid solution precipitates barium sulphate; ammonia added to the solution gives the blue color due to copper. Gives a small amount of water in a closed tube.

Inyo County: **1**, Caledonite was found with linarite and leadhillite at the Cerro Gordo mines, A. F. Rogers (1) p. 46, Eakle (9) p. 227. Guild (1) p. 330, described bright-green crystals from this locality. **2**, It was found with linarite, etc. at the Wonder prospect, Darwin district, A. Knopf (4) p. 17. **3**, It occurs with linarite and crystallized cerussite in the Monster mine, northwest of Saline Valley, on the east flank of the Inyo Range, A. Knopf (5) p. 111. **4**, Caledonite and linarite came from the Reward mine, 2 miles east of Manzanar, A. Knopf (5) p. 118.

Mono County: **1**, It was reported in the Blind Spring Hill district, Hulin (p. c., '36).

San Bernardino County: **1**, Caledonite occurs with linarite and dioptase at a mine in the Soda Lake Mountains near Baker, Murdoch (p.c. '49), (S.M.B. 31250).

CALIFORNIA IRIS

See spodumene

CALIFORNIA JADE

See vesuvianite

CALIFORNITE

See vesuvianite

CALOMEL

Mercurous chloride, HgCl

Tetragonal. Small crystals. Sectile. Adamantine luster. Color white, gray, brown. Streak pale yellowish white. H = 1-2. G. = 6.48.

Volatilizes easily on charcoal and coats the coal white. Calomel is easily reduced to mercury globules by fusion with soda.

Napa County **1,** White coatings of calomel on metacinnabar were found in the Boston quicksilver mine on Oat Hill, S. M. B. (16284).

Orange County: **1,** A persistent amount of chlorine in analyses of metacinnabar from Red Hill, indicates the presence of calomel, although this mineral was not otherwise recorded from this locality, Genth and Penfield (10) p. 383.

San Mateo County: **1,** Small amounts of calomel, native mercury, cinnabar and eglestonite occur on the Corte de Madera Rancho (?) 5 miles west of Palo Alto, A. F. Rogers (5) p. 48.

CAMSELLITE

See szaibelyite

CARBONADO

See diamond

CARNELIAN

See quartz, chalcedony

CASSITERITE—Tin Stone

Tin dioxide, SnO_2

Tetragonal. Crystals low pyramidal; twins common. Massive, granular; in rolled grains. Brittle. Adamantine luster. Color brown, black; sometimes red, gray, white, yellow. Streak white, grayish, brownish. H.= 6.7. G. = 7.1.

Infusible and insoluble. With sodium carbonate on charcoal can be reduced to globules of metallic tin. These globules, intensely heated with cobalt nitrate, will give a bluish-green coating.

Amador County: **1,** A 5-foot "vein of tin" on the Mokelumne River below Big Bar, W. P. Blake (28) p. 615, is most probably garnet.

Butte County: **1,** Cassiterite was reported from Goat Flat, Engineering and Mining Journal (19) p. 855.

Inyo County: **1,** There is an unverified report in the Mining and Scientific Press for 1901, of cassiterite nuggets from Bishop Creek, Segerstrom (1) p. 550.

Kern County: **1,** Nodules and stringers of cassiterite, some up to 3 tons weight, in limonite gossan, occur at the Meeke (Hogan) tin mine 4 miles north of Quail Lake, near Gorman, Mallery (2) no. 2, p. 8, Wiese and Page (1) p. 39, Page (3) p. 202, Wiese (2), p. 46.

Napa County: **1,** Cassiterite was doubtfully reported from the lower end of Chiles Valley, L. L. Palmer (1) p. 28.

Orange County: **1**, Cassiterite was found at the Trabuco tin mine, Trabuco Canyon, Mining and Scientific Press, (30) p. 117, Segerstrom (1) p. 550.

Placer County: **1**, One nugget was found in the Middle Fork, Feather River, 3 miles above Big Bar, W. P. Blake (23) p. 376, (24) p. 208.

Riverside County: **1**, The most important deposit of cassiterite in the state was discovered in the Temescal district (secs. 2, 3, 10, 11, T. 4 S., R. 6 W., S. B.), C. T. Jackson (1) p. 152. According to Benedict (1) p. 450, the Indians knew of the presence of tin here as early as 1840. There are many references to this deposit, of which the more important are: Hanks (12) p. 120, Kunz (24) p. 105, Fairbanks (18) pp. 39-42. Besides the principal occurrences, there were other smaller deposits in the general vicinity. One of the more important of these is the Chief of the Hills (sec. 4, T. 6 S., R. 4 W., S. B.), 2 miles northeast of Elsinore, R. J. Sampson (9) p. 516, Segerstrom (1) p. 551.

San Bernardino County: **1**, Crystals of cassiterite occur with scheelite in a vein in dolomitic limestone at the Evening Star mine (sec. 30, T. 15 N., R. 14 E., S. B.), Tucker and Sampson (34) p. 498.

San Diego County: **1**, It occurs with other pegmatite minerals in the Himalaya mine at Mesa Grande, Schaller (36) p. 352. **2**, With topaz in the Little Three mine near Ramona, ibid. p. 352. **3**, A little cassiterite was found with columbite, tourmaline, etc., in a pegmatite in the Chihuahua Valley (SW$\frac{1}{4}$ sec. 12, T. 9 S., R. 3 E., S. B.), ibid. p. 351. **4**, It is found in a pegmatite with lepidolite and amblygonite, on Granite Mountain, about 3 miles southeast of Banner (NW$\frac{1}{4}$ sec. 18, T. 13 S., R. 5 E., S. B.), Schaller (p.c., '46). **5**, Sanford and Stone (1) p. 26, report cassiterite from Pala [doubtful]. **6**, Placer tin was supposedly found on the east slope of Laguna Mountain, F. J. H. Merrill (1) p. 669. Merrill also reports other possible occurrences in Pine Valley; **7**, at the south end of Viejas Mountain east of Alpine; and **8**, in the Defiance copper district, west of the Santa Margarita grant. These are all rather doubtful.

Santa Barbara County: **1**, Some cassiterite was found as float by Captain Stoddon in the San Rafael Mountains, Angel (2) p. 596.

Santa Clara County: **1**, Fine large crystals were found in the eclogites, quartzite, and diorite of Oak Hill, near San Jose, Schrader et al. (1) p. 46.

Siskiyou County: **1**, Cassiterite was found as float in Hungry Creek, Hess and Graton (1) p. 165. **2**, Stream tin is found in the gravels at Sawyers Bar (N. R.).

Sonoma County: **1**, A sample of stream tin, S. M. B. (18306), came from this county.

Trinity County: **1**, One large specimen was found in the soil near Weaverville, J. D. Whitney (6) p. 181, and several other small nuggets have been found near by, Segerstrom (1) p. 552.

CASTANITE

See hohmannite

CELADONITE

Hydrous iron, magnesium, and potassium silicate, close to glauconite

Earthy or in minute scales. Color deep olive green or apple green. Greasy feel. H. = 1. G. = 2.7.

Fusible. Soluble in hydrochloric acid.

Kern County: **1**, Green crystalline linings of cavities in basalt, have been identified by X-ray photographs as this mineral. It had previously been tentatively called "Corundophilite" Murdoch (p.c. '53).

San Mateo County: **1**, S. M. B. (8961) comes from the San Gregorio Ranch, near San Mateo, Irelan (4) p. 46.

CELESTITE

Strontium sulphate, $SrSO_4$

Orthorhombic. Crystals commonly tabular or prismatic; also fibrous and radiated. Cleavage perfect basal. Vitreous luster. Colorless, pale bluish. Streak white. H. = 3-3½. G. = 3.95-3.97.

Similar to barite in its reactions, except that the flame is deep carmine red. Insoluble in acids.

"Baryto-celestite" is barium celestite.

Inyo County: **1**, Slender bluish crystals occur with colemanite in Death Valley, Eakle (9) p. 230.

Los Angeles County: **1**, Minute celestite crystals occur on a crust of bakerite at the Sterling borax mine, Tick Canyon, Murdoch (p.c. '49).

San Benito County: **1**, A 3-inch vein of celestite was found in old workings of the Butts quicksilver mine near Pine Rock, Tucker (11) p. 247.

San Bernardino County: **1**, Geodes in the colemanite ores at Borate, in the Calico Hills, are lined with strontianite and light-blue to colorless celestite crystals up to 4 cm in length, Eakle (9) p. 230, Foshag (9) p. 208; D. J. Henry (1) p. 231, reports pseudomorphs of celestite after satin spar. **2**, Slender pointed crystals occur in open fissures in the old Owens borax mine, at the north base of Lead Mountain, near Barstow, H. S. Gale (17), p. 10, and Durrell (8), p. 9. **3**, In the Mud Hills, and Strontium Hills, north of Barstow, (T. 11 N., R. 1, 2 W.; sec. 20, T. 11 N., R. 1 W., S. B.), it occurs with strontianite in glassy aggregates or slender prismatic crystals, A. Knopf (9) p. 263, Durrell (8) p. 23. **4**, An extensive zone of impure celestite associated with gypsum is found in T. 17, 18 N., R. 4, 5, 6 E., S. B., 10 miles northwest of Silver Lake in the Avawatz Mountains, Phalen (3) p. 526, B. N. Moore (1) p. 359. **5**, Extensive beds of massive celestite, 10 to 20 feet thick, occur 4 miles northwest of Ludlow (secs. 29, 30, T. 8 N., R. 7 E., S.B.), Mallery (1) p. 952, Tucker (4) p. 367, B. N. Moore (1) p. 357, Durrell (8), p. 37. **6**, An extensive deposit of celestite as concretions of massive material is found on the southwest margin of Bristol Dry Lake, south of Amboy (S½ sec. 6, T. 4 N., R. 12 E., S. B.), H. S. Gale (17), p. 10, confirming Durrell (p.c. '45). **7**, It is one of the minerals occasionally found at Searles Lake, Hanks (17) p. 63, DeGroot (3) p. 537. **8**, Celestite occurs in shales with nodular barite at Owl Holes (sec. 23, T. 18 N., R. 3 E., S. B.), Murdoch and Webb (11) p. 550, Durrell (8) p. 15. **9**, Barian celestite (baryto-celestite) has been tentatively identified in the bastnaesite occurrence at Mountain Pass, Pray and Sharp (1) p. 1519.

San Diego County: **1**, Finely crystalline celestite underlain by gypsum occurs in the Fish Creek area, described as "Fish Mts." by Moore (1), p. 365, and located in Imperial County. Durrell (8), p. 5, corrects the location and describes the deposit.

CELSIAN

See feldspar

CENTRALLASITE

Hydrous calcium silicate, $Ca_4Si_6O_{15}(OH)_2 \cdot 5H_2O$

Platy or lamellar to compact. Color white. H. = 2½. G. = 2.51.

Fuses easily with intumescence. Soluble in hydrochloric acid with separation of silica.

Riverside County: **1**, Centrallasite was described by Foshag (12) p. 88, as occurring in platy to compact masses between feldspars, and associated with prehnite and datolite, in a pegmatite in the Wet Weather quarry at Crestmore. Analysis by Foshag:

H_2O	SiO_2	Al_2O_3	CaO	MgO
11.88	57.00	0.26	30.86	0.20 = 100.20%

CERARGYRITE—Horn Silver

Silver chloride, AgCl

Isometric. Usually in crusts, resembling wax or horn; sometimes columnar. Highly sectile. Luster, resinous to adamantine. Color gray, but darkens readily on exposure to the air. H. = 1-1½. G. = 5.55.

Easily reduced on charcoal to metallic silver. Mixed with copper oxide it imparts to the flame the azure-blue color of copper chloride. Insoluble in acids, but soluble in ammonia.

Calaveras County: **1**, Thin crusts of cerargyrite on quartz were reported by W. P. Blake (14) p. 124, from the Morgan mine at Carson Hill.

Inyo County: It was fairly abundant in some of the mines of the Argus and Coso Ranges, and in the Inyo Range, with lesser occurrences in the Panamints and ranges to the southward. **1**, Argus Range: Tucker and Sampson (25) p. 445, in fine microscopic crystals at the Modoc mine (sec. 34, T. 19 S., R. 42 E., M. D.). **2**, Coso Range: De Groot (2) p. 213, Crawford (1) p. 374, Tucker (11) p. 488, Murphy (2) p. 322. **3**, It was abundant in the upper workings at the Darwin mines, Tucker and Sampson (25) p. 546. **4**, Inyo Range: Massive cerargyrite was fairly abundant in the upper levels of the Cerro Gordo mine, Woodhouse (p.c., '45). **5**, It was found associated with argentite and wulfenite in the Kearsarge district, 8 miles from Independence, Wheeler (1) p. 45. **6**, Found as crusts in the Tecopa district, Woodhouse (p.c., '45). **7**, It was reported from the Chrysopolis district, Engineering and Mining Journal (15) p. 1176. **8**, It was also reported from the Slate Range, Hanks (12) p. 124. **9**, At the Minietta mines, Argus Range, Woodhouse (p.c., '54).

Kern County: **1**, It occurred at the Amalie mine with proustite and argentite (T. 31 S., R. 36 E., M. D.), Dyke (1) p. 764. **2**, Several of the mines in the Mojave district carried a little cerargyrite with argentite in the gold veins, Bateson (1) p. 171, Tucker and Sampson (21) p. 298; Lodestar or Morningstar mine, Tucker (37) p. 221.

Los Angeles County: **1**, A little cerargyrite was associated with silver, argentite, and cobalt minerals at the Kelsey mine in San Gabriel Canyon, Irelan (4) p. 208.

Mono County: **1**, It was found sparingly in the Blind Spring Hill district near Benton, Whiting (1) p. 378. **2**, With native silver near Bodie, ibid. p. 389. **3**, At the Silverado mine (sec. 19, T. 7 N., R. 25 E., M. D.), in the Patterson district, Sweetwater Range, ibid. p. 359, Eakle and McLaughlin (17) p. 166. **4**, A little was found with cuprite and chrysocolla at Lundy, Hanks (12) p. 139. S. M. B. (5158).

Napa County: **1**, "Silver chlorides" were reported from the Mount St. Helena (Silverado) mine, with sulphides and free gold, Boalich (4) p. 159.

Placer County: **1**, A mass of ore with wire silver and cerargyrite was discovered in 1871 in the Elizabeth Lode in the Ophir district, Mining and Scientific Press, (14) p. 241. **2**, Cerargyrite was found abundantly in other veins in the district, Lindgren (7) p. 272. **3**, Beautiful specimens have come from the Whitlach mine in Marshall Canyon, Engineering and Mining Journal (1) p. 66.

San Bernardino County: Many localities in this county have produced small amounts of cerargyrite, and it has been found abundantly in several places. **1**, It was the principal silver ore in the old Calico district, associated with embolite, wulfenite, etc., Cloudman et al. (1) p. 829, Lindgren (1) pp. 721-728, Storms (2) p. 382. **2**, It was the most important mineral in the oxidized zone of the California Rand mine, and others in that district, Hulin (1) p. 98. **3**, Small deposits of rich ore were found in the Ord district (T. 7 N., R. 2 E., S. B.), Cloudman et al. (1) p. 809. **4**, Crystals came from the Silver Reef district 40 miles east of Victorville, Storms (4) p. 366. **5**, Other minor occurrences are as follows: Trojan (Providence) district, De Groot (2) p. 532; Lava Bed district (T. 7 N., R. 4, 5 E., S. B.), ibid. p. 528; Dale district, Tucker and Sampson (27) p. 61; Kingston Range (T. 18 N., R. 13 E., S. B.), Tucker (8) p. 94; Grapevine district (T. 10 N., R. 1 W., S. B.), Tucker and Sampson (28) p. 245; 9 miles north of Bagdad, Tucker (8) p. 97; Halloran Springs (T. 14 N., R. 10 E., S. B.), Tucker and Sampson (17) p. 273; Ivanpah district, Loew (2) p. 186, Tucker (8) p. 94; Old Woman Mountains (T. 1 N., R. 21 E., S. B.), Irelan (4) p. 217; 3 miles east of Cima, New York Mountains, Tucker and Sampson (16) p. 276; at the Black Metal mine, 3 miles west of the Colorado River and 50 miles southeast of Needles, Tucker and Sampson (17) p. 266; Calarivada mine (T. 18 N., R. 13 E., S. B.), ibid. p. 266; a little was found at Searles Lake, De Groot (2) p. 537; Waterman mine (sec. 13, T. 10 N., R. 2 W., S. B.), Wright et al. (5) p. 139.

San Diego County: **1**, Cerargyrite was found 3 miles south of Julian, in ore with copper minerals, S. M. B. (9979).

Shasta County: **1**, Small perfect crystals were found at the Silver King mine, 4 miles west of Redding, Hanks (15) p. 98.

CERUSSITE—White Lead Ore

Lead carbonate, $PbCO_3$

Orthorhombic. Platy crystals. Generally massive. Two cleavages distinct. Fracture conchoidal. Very brittle. Adamantine to vitreous luster. Color gray, creamy white, brown. Streak uncolored. H. = 3-3½. G. = 6.46-6.57.

Easily fusible. Fused on charcoal with sodium carbonate, reduces to metallic globules of lead and gives yellow coating. Soluble in nitric acid with effervescence.

Imperial County: **1**, Cerussite was found with argentiferous galena, in small veins and pockets at the Mayflower mine (sec. 11, T. 14 S., R. 22 E., S. B.), F. J. H. Merrill (1) p. 732. **2**, It was also found in the Paymaster district (T. 11 S., R. 19, 20 E., S. B.), Tucker (11) p. 262.

Inyo County: More than 30 occurrences are recorded from this county, most of them relatively unimportant. **1**, Large crystals came

from the Union mine in the Russ district (sec. 14, T. 6 S., R. 30 E., M. D.), Hanks (12) p. 124. **2**, It was an important mineral at the Cerro Gordo mine, ibid. p. 124. **3**, Cerussite was relatively common in the Darwin district, A. Knopf (4) p. 7. **4**, It was the principal ore mineral at the Carbonate mine near the base of the east slope of the Panamint Mountains, C. A. Waring and Huguenin (2) p. 89. **5**, Fine crystals came from the Modoc mine (sec. 34, T. 19 S., R. 42 E., M. D.), Hanks (12) p. 124. **6**, Well-crystallized cerussite with linarite and caledonite were found in the Monster mine, northwest of Saline Valley, A. Knopf (5) p. 111. **7**, Cerussite with wulfenite was found at the Empire mine (T. 21 S., R. 45 E., M. D.), W. P. Blake (14) p. 125. **8**, Minor occurrences are reported from the Panamint Range, Argus and Slate Ranges, northern end of the Inyo Range, Tecopa and Resting Springs area, Chloride Cliff, etc.: Stetefeldt (1) p. 259; Ball (1) p. 73; Tucker (4) pp. 286, 291, etc.; Tucker (11) pp. 453-530; McAllister (2) and others.

Madera County: **1**, Reported in some of the lead ores on Shadow and Johnson Creeks, Minaret district, Goudey (1) p. 7.

Mono County: **1**, Occasionally common in veins rich in galena, in the Blind Spring Hill district, Whiting (1) p. 378, A. L. Ransome (2) p. 190. **2**, It was found on the west slope of the White Mountains, between Coldwater and Piute Canyons (T. 5 S., R. 33 or 34 E., M. D.), R. J. Sampson (14) p. 139.

Monterey County: **1**, A little cerussite came from the Alisal Rancho, in cavities of galena, associated with a small quantity of native arsenic, W. P. Blake (4) p. 301.

Orange County: **1**, Occurs sparingly at "Carbonate Hill" in Santiago Canyon, Bowers (4) p. 403.

Riverside County: **1**, Occurs with galena in the Free Coinage mine, Hodges Mountain district (T. 7, 8 S., R. 21 E., S. B.), F. J. H. Merrill (2) p. 541. **2**, Also in the Steele mine, Pinacate district (SE¼ sec. 32, T. 4 S., R. 4 W., S. B.), ibid. p. 532. **3**, Found with vanadinite and sulphides at the Black Eagle mine, (sec. 30, T. 3 S., R. 14 E., S. B.), Tucker (8) p. 195.

San Bernardino County: **1**, Massive cerussite occurs with chrysocolla in the Total Wreck mine and Langtry Lode half a mile west of Calico. It occurs sparingly elsewhere in the district, Lindgren (1) p. 727, Storms (3) p. 383. **2**, It is prominent in the Silver Mountain district, 5 miles west of Oro Grande, Storms (4) p. 364. **3**, It occurs with linarite, smithsonite etc., in the Ibex mine, 6 miles north of Saratoga Springs, Cloudman et al. (1) p. 821. **4**, Found with smithsonite and hydrozincite at the Carbonate mine (sec. 32, T. 16 N., R. 14 E., S. B.), Ivanpah district, Tucker (4) p. 363, Tucker and Sampson (33) p. 128. **5**, It occurs in the Lava Beds district with wulfenite, anglesite etc., Tucker and Sampson (17) p. 351. **6**, It was found with vanadinite and cuprodescloizite at Signal, near Goffs, Schaller (24) p. 149. **7**, Cerussite was also reported in small amounts from the following districts: Grapevine (T. 10 N., R. 1 W., S. B.), Tucker and Sampson (28) p. 245; Lead Mountains (T. 4 N., R. 10 E., S. B.), Tucker (8) p. 95; Resting Springs, Tucker (4) p. 366; Oro Grande, Crossman (1) p. 233; Old Woman Mountains, ibid. p. 217; Clark Mountain, (T. 17 N., R. 13 E., S. B.), Tucker (4) p. 340; Dale, Tucker and Sampson (27) p. 61; Holcomb Valley, Tucker (4) p. 362.

Shasta County: **1**, Cerussite occurs with pyromorphite, tetrahedrite etc., at the Chicago claim, 3 miles west of Igo, W. P. Blake (14) p. 125.

Sonoma County: **1**, It is found as a heavy yellow concentrate in sands near Healdsburg, W. W. Bradley (26) p. 608.

Tulare County: **1**, It occurs in the Silver Crown group (sec. 7, T. 23 S., R. 33 E., M. D.), Tucker and Sampson (29) p. 331.

CERVANTITE

Antimony oxide, Sb_2O_4(?)

Orthorhombic. Acicular crystals rare; usually a crust or powder. Sometimes massive. Color yellow to white. H. = 4½. G. = 4.

Infusible. The antimony oxide coating on charcoal is obtained only with the aid of a flux like sodium carbonate.

Cervantite occurs as an alteration product of stibnite or native antimony.

Inyo County: **1**, White or light-yellow cervantite is associated with valentinite in Wild Rose Canyon, D. E. White (1) p. 317, Mining and Scientific Press (38) p. 368. **2**, A specimen S. M. B. (8584) shows probable cervantite from Cerro Gordo. **3**, Cervantite was found as an alteration product of stibnite in the Darwin district, Kelley (4) p. 544. **4**, It was reported with metastibnite and valentinite 4½ miles south of Bishop, Woodhouse, (p. c., '45).

Kern County: **1**, Reported from "San Amedio" Mountain by Hanks (12) p. 124. A specimen from this county in the American Museum of Natural History, is a pseudomorph of cervantite after antimony, Frondel (1) p. 407.

Mono County: **1**, It was recorded from the Blind Spring Hill district, Loew (1) p. 654.

San Bernardino County: **1**, Clear yellow, colorless, or white coatings on vugs in ore, with pyrostilpnite, was found in the California Rand mine, Red Mountain, Murdoch (12) p. 131.

San Luis Obispo County: **1**, Found with stibiconite on antimony ores at the Marquart mine (T. 26 S., R. 9 E., M. D.), Eckel et al. (1) p. 537, 543.

CHABAZITE

Hydrous calcium, sodium, and aluminum silicate, $(Ca,Na,K)_7Al_{12}(Al,Si)_2Si_{26}O_{80}\cdot 40H_2O$

Hexagonal-rhombohedral. Crystals nearly cubic. Rhombohedral cleavage very poor. Brittle. Vitreous luster. Color white, flesh red. Streak uncolored. H. = 4-5. G. = 2.08-2.16.

Fuses with light swelling. Decomposed by hydrochloric acid, but without gelatinization. Gives much water in a closed tube.

Chabazite is a zeolite occurring as a secondary mineral in cavities of basic volcanic rock.

Mono County: **1**, Minute colorless or whitish crystals of chabazite line narrow fissures in biotite schist near the head of McGee Creek (approx. lat. 37° 10′ N, long. 118° 50′ W), Mayo (p. c., '32).

Nevada County: **1**, Colorless crystals several millimeters across form coatings of fissures in diabase at the Star mine, Grass Valley, Lindgren (12) p. 120.

Plumas County: **1**, Pseudocubic crystals occur in basalt at the Dodson mine, Mooreville Ridge, Turner (4) p. 490.

Shasta County: **1**, Chabazite is found with natrolite, tridymite, and analcime in amygdaloidal basalt on Round Mountain, Melhase (3) no. 6, p. 1.

CHALCANTHITE—Blue Vitriol

Hydrous cupric sulphate, $CuSO_4 \cdot 5H_2O$

Triclinic. Crystals commonly flattened. Massive, stalactitic, and fibrous. Brittle. Vitreous luster. Color greenish blue to sky blue. Streak uncolored. H. = 2½. G. = 2.12-2.30.

Fusible. In a closed tube yields water. Soluble in water. Gives the blue solution of copper when ammonia is added.

Chalcanthite is common in mine workings where it results from the oxidation of copper sulphides.

Alameda County: **1,** Abundant as massive coatings and crystals with melanterite etc., at the Alma pyrite mine, Leona Heights, Schaller (1) p. 212.

Alpine County: **1,** In considerable amounts in mine openings at the Leviathan sulphur mine, 7 miles east of Markleeville, Gary (1) p. 488.

Calaveras County: **1,** "Cyanosite" (chalcanthite) was reported by Silliman (7) p. 351, from Quail Hill.

Fresno County: **1,** Chalcanthite was found at the Nieper copper mine (sec. 34, T. 11 S., R. 23 E., M. D.), Goldstone (1) p. 194.

Mono County: **1,** Chalcanthite was found in the Masonic district, W. W. Bradley (26) p. 606.

Nevada County: **1,** It was reported from Sweetland, Mining and Scientific Press (3) no. 13, p. 5, Hanks (12) p. 124.

Placer County: **1,** It occurs with native silver, coquimbite, etc. at the Valley View mine, Whiskey Hill, 6 miles north of Lincoln, Silliman (7) p. 351, Logan (17) p. 40.

Shasta County: **1,** Common at the Peck mine, Copper City, Hanks (12) p. 124.

Trinity County: **1,** Found with other sulphates at the Island Mountain copper mine, Vonsen (p.c., '45). **2,** Considerable amounts were found with chalcopyrite etc. in the New River district, Aubury (4) p. 144.

CHALCEDONY

See quartz

CHALCOCITE—Copper Glance—Redruthite

Cuprous sulphide, Cu_2S

Orthorhombic. Crystals rare with deeply striated faces. Generally compact massive. Metallic luster. Color dark lead gray to black. Streak black. Sectile. H. = 2½-3. G. = 5.5-5.8.

Chalcocite is easily reduced to metallic copper on charcoal. When dissolved in nitric acid and ammonia is added, produces a blue solution. Some reddish ferric hydrate is apt to be precipitated as an impurity.

Chalcocite is common in many of the copper mines of the state, but large bodies of this valuable copper mineral are rare. Bornite and chalcopyrite are often intermixed with the chalcocite, and malachite commonly coats the surfaces of specimens.

Alpine County: **1,** Some chalcocite occurs in the ore from the old Billy Rogers claim in Hope Valley, reputed to be the earliest copper claim in California [1855], Woodhouse (p.c., '45). **2,** Chalcocite from the Globe mine, Monitor district (SW¼ sec. 31, T. 10 N., R. 21 E., M. D.) carried some gold and silver values, Logan (4) p. 404.

Calaveras County: **1,** Chalcocite was reported from Quail Hill, Silliman (7) p. 351. **2,** Small amounts of massive chalcocite have been found

at Campo Seco and Copperopolis, also at Angels Camp and Hog Hill (N.R.).

Colusa County: **1**, It was found massive at the American mine (N.R.).

Del Norte County: **1**, It was found abundantly with magnetite in serpentine at the Cleopatra mine 18 miles east of Smith River, in the Diamond Creek District, Hershey (4) p. 429. **2**, At the Alta mine, Copper Creek, Maxson (1) p. 148. **3**, Near Low Divide, in the Rockland district, J. D. Whitney (7) p. 362. **4**, With carbonates and oxides in the Higgins Mountain group on the Siskiyou Fork, Smith River, 5 miles from North Monkey Creek, Aubury (1) p. 116.

El Dorado County: **1**, Chalcocite occurred with bornite and chalcopyrite in the old Cosumnes copper mine near Fairplay (N. R.). Also **2**, at the Boston mine, Latrobe (N. R.).

Fresno County: **1**, A little chalcocite was found at the Fresno copper mine (T. 12 S., R. 21 E., M. D.), Aubury (1) p. 226.

Humboldt County: **1**, A vein up to 1 foot wide in schist occurs in the Horse Mountain mine (sec. 33, 34, T. 6 N., R. 4 E., H.), Averill (10) p. 508. **2**, It was found also in the Iron Mountain mine, Mad River district, S.M.B. (15686). **3**, Chalcocite, with cuprite and native copper occur as float at the Red Cap mine, 50 miles north of Eureka, on the divide between Red Cap and Boise Creeks, Hershey (4) p. 429.

Imperial County: **1**, Some secondary chalcocite is found in the Cargo Muchacho district, Henshaw (1) p. 185.

Inyo County: **1**, It occurs in all mines of the Ubehebe district, and some handsome specimens have been collected, Aubury (4) p. 302. **2**, A small amount occurs in the Panamint district, Murphy (2) p. 323. **3**, Some chalcocite was found with tetrahedrite and other sulphides at the Ashford (Golden Treasure) mine on the east side of Death Valley, Tucker and Sampson (25) p. 383. **4**, Chalcocite was found with oxides and carbonates in the Greenwater district, Black Mountains, Zalinski (1) p. 81.

Kern County: **1**, A little chalcocite is found with chalcopyrite, in veins in granodiorite at the Greenback copper mine (sec. 1 etc., T. 26 S., R. 29 E., M. D.), Tucker (4) p. 308.

Lake County: **1**, Some chalcocite occurs with malachite at the Langtry ranch (T. 10 N., R. 7 W., M. D.), 7 miles south of Middletown, S. M. B. (15727).

Lassen County: **1**, Fine material has come from the Lummis mine, Woodhouse (p.c. '45).

Los Angeles County: **1**, Irregular masses occur in syenitic granite at the Maris mine, Soledad district, W. P. Blake (9) p. 12. This may be the same locality described by W. P. Blake (7) p. 291, as "7 miles below the summit of Williamson's Pass, almost 90 feet above the bed of the stream."

Madera County: **1**, Chalcocite occurs with chalcopyrite in a small vein north of the Jessie Bell mine near Daulton, Forstner (4) p. 747, and is reported from the old Buchanan mine in the same locality (N. R.).

Mariposa County: **1**, Small amounts of a "dark blue or blue black sulphide," presumably chalcocite, were found in the Pocahontas mine (T. 7 S., R. 17 E., M. D.), Aubury (1) p. 210. **2**, It occurs at La Vic-

toria mine (T. 4 S., R. 16 E., M. D.), ibid. p. 213. **3,** With native copper at the Copper Queen mine (T. 5 S., R. 19 E., M. D.), ibid. p. 216.

Mono County: **1,** Chalcocite is found sparingly as secondary veinlets in the mines at Blind Spring Hill, A. L. Ransome (2) p. 172.

Napa County: **1,** With covellite at the Jumper Mines (N. R.).

Nevada County: **1,** With bornite and covellite in the enriched zone, Mineral Hill district near Spenceville (T. 15 N., R. 6 E., M. D.), Forstner (4) p. 745. **2,** Also at Cisco, and **3,** at Meadow Lake (N. R.).

Placer County: **1,** Small amounts of chalcocite occur at the Valley View mine, Whiskey Hill, with sulphates, Silliman (7) p. 350.

Plumas County: **1,** Rich chalcocite-bornite ore has been mined in the Genesee Valley district, J. D. Whitney (7) p. 309, Hanks (15) p. 100. **2,** It was abundant in the Engels mine, intergrown with bornite, Turner and Rogers (32) p. 379. **3,** Found with bornite and chalcopyrite from the Gruss copper mine, Portola, Engineering and Mining Journal (25) p. 543. **4,** Chalcocite shows microscopic ''graphic'' intergrowth with bornite from Surprise Creek, A. F. Rogers (17) p. 593.

Riverside County: **1,** A little chalcocite is present in the limestone at Crestmore, Eakle (15) p. 353. **2,** It occurs with cuprite in the Palen Mountains (secs. 29, 30, T. 4 S., R. 20 E., S. B.), F. J. H. Merrill (2) p. 526.

San Benito County: **1,** Small crystals of chalcocite occur scattered through the natrolite of the benitoite vein, near the headwaters of the San Benito River, Louderback and Blasdale (5) p. 359.

San Bernardino County: **1,** A considerable amount of pyrite-chalcocite ore came from the Pacific Mines Corp., 7 miles south of Ludlow, Cloudman et al. (1) p. 790. **2,** A little chalcocite is associated with bornite, chalcopyrite, and tetrahedrite in the Calico district, Weeks (4) p. 534. **3,** It is found in the Ivanpah and Ord districts, Loew (2) p. 186, Tucker and Sampson (17) p. 267. **4,** Chalcocite occurs as a secondary mineral in the new American Eagle mine (sec. 31, T. 3 N., R. 24 E., S. B.), Wright et al. (5) p. 65. **5,** It is found in many other mines in the county, in small amounts. No specific references are available.

San Diego County: **1,** Massive chalcocite comes from Potrero, S. M. B. (10037).

Shasta County: **1,** It is widespread but not abundant in the copper mines of the county: Bully Hill, Afterthought, Copper City, Iron Mountain, Balaklala, Silver King, Greenhorn, etc. Reported in Aubury (1) p. 65; Laizure (1) p. 528; Tucker (9) pp. 427, 445; Averill (9) p. 127.

Sierra County: **1,** Chalcocite occurs in very minor amounts in the Alleghany district, E. M. Boyle (3) p. 4.

Siskiyou County: **1,** It has been reported from the Yellow Butte mine 12 miles northeast of Weed, the Copper King mine, and the Bonanza mine near Honolulu (N. R.).

Trinity County: **1,** It occurs as local enrichment in the Copper Queen lode, in the Carrville district, MacDonald (2) p. 17. **2,** A small amount of ''sooty chalcocite'' is found in the Island Mountain mine, Vonsen (p.c. '45). **3,** It occurs with native copper and carbonates on the North Fork, Trinity River, near the main stream, J. B. Trask (1) p. 24.

Tuolumne County: **1,** A considerable amount of chalcocite was found in the upper levels of the Oak Hill mine, Aubury (4) p. 250.

7—33804

CHALCODITE
See stilpnomelane

CHALCOPYRITE—Copper Pyrites
A sulphide of copper and iron, $CuFeS_2$

Tetragonal; scalenohedral. Generally massive. Metallic luster. Color deep brass yellow, often with iridescent tarnish. Streak greenish black. H. = 3½-4. G. = 4.1-4.3.

Fusible and soluble. Ammonia added to a nitric-acid solution precipitates reddish ferric hydrate and turns solution blue. Becomes magnetic after roasting and small globules of copper are obtained by reduction with soda. Distinguished from pyrite by deeper color and presence of copper; from bornite by its brass color; from gold by its ready solubility in nitric acid.

Chalcopyrite is the universal copper mineral, abundant in practically all copper ores, and present in nearly every mineral vein, and therefore in almost every county in the state. Only the most important occurrences can be listed in detail. Good general references to copper ores are A. Knopf (2), and Aubury (1) and (4).

Alameda County: **1**, Small amounts of chalcopyrite are present in the massive pyrite at the Alma mine, Leona Heights, Schaller (1) p. 194.

Alpine County: **1**, Found with enargite and other sulphides in the Mogul district, Eakle (16) p. 13.

Amador County: **1**, It is the chief ore mineral at the Jackson (Newton) mine 3 miles northeast of Ione, Storms (9) p. 87. **2**, It occurs in minor amounts in some of the other mines of the county: Copper Hill (secs. 34, 35, T. 8 N., R. 9 E., M. D.), Ione City, Bull Run, etc. Aubury (1) pp. 185, 186.

Calaveras County: **1**, Many tons of chalcopyrite ore were mined in this county. The principal producers were the Copperopolis, Campo Seco, Lancha Plana, Union, and Keystone mines, Reid (3) p. 398, Aubury (1) p. 190. Minor amounts occur in the gold ores, Moss (1) p. 1011, Franke and Logan (4) p. 239.

Colusa County: **1**, Associated in small amount with cinnabar, gold, and stibnite at the Manzanita mine, Becker (4) p. 367.

Contra Costa County: **1**, Occurs with gold and bornite at a prospect in a ravine tributary to Mitchell Canyon on Mount Diablo, Turner (1) p. 391.

Del Norte County: **1**, Many mines in the Low Divide and Shelly Creek areas carry some chalcopyrite, Aubury (1) p. 27.

El Dorado County: **1**, Good specimens of chalcopyrite, with bornite, molybdenite, garnet, epidote, and axinite have come from the old Cosumnes mine near Fairplay, Tucker and Waring (2) p. 276. **2**, Considerable chalcopyrite has been produced from other mines in the Foothill copper belt in this county: Alabaster Cave (secs. 10, 15, T. 11 N., R. 8 E,. M. D.), Lilyama (sec. 3, T. 11 N., R. 9 E., M. D.), Cambrian (sec. 23, T. 11 N., R. 9 E., M. D.), Boston (sec. 22, T. 4 N., R. 9 E., M. D.), etc., Aubury (1) pp. 176-181.

Fresno County: **1**, Chalcopyrite is abundant in the Copper King mine (sec. 3, T. 12 S., R. 23 E., M. D.), Crawford (1) p. 66. **2**, At the Fresno copper mine, Aubury (4) p. 281. **3**, Massive at the Nieper copper mine (sec. 34, T. 11 S., R. 23 E., M. D.), Goldstone (1) p. 194.

Humboldt County: **1**, Boulders of massive pyrite and chalcopyrite occur on the seashore at Patrick's Point, 6 miles north of Trinidad, Aubury (4) p. 155. **2**, It occurs on Horse Mountain (T. 6 N., R. 4 E., H.), Lowell (1) p. 397. **3**, A vein up to 7 feet in width was reported on the Hoopa Indian Reservation (sec. 2, T. 8 N., R. 4 E., H.) Averill (10) p. 508.

Imperial County: **1**, Small amounts of chalcopyrite are present in the gold veins of the Picacho, Cargo Muchacho, and other districts in the county, Tucker (11) p. 252, Tucker and Sampson (27) pp. 16, 17, R. J. Sampson and Tucker (18) pp. 115, 125.

Inyo County: **1**, Chalcopyrite is found in many of the gold and lead-silver deposits, in the Darwin, Argus, Coso, Inyo, Panamint, and other areas in the county, nowhere in considerable amount. Specific localities may be found listed in Aubury (1) p. 245, Tucker (11) pp. 469-473, Tucker and Sampson (25) pp. 383-413, Kelley (4) p. 543.

Kern County: **1**, Some chalcopyrite is found in most of the gold mines of the county: Valley View, Rademacher, Goler, Woody, Mojave, and other districts: Tucker (4) p. 308; Tucker and Sampson (21) pp. 314, 360; Simpson (1) p. 409; Tucker and Sampson (29) pp. 323, 329. **2**, It was reported with wolframite near Woody (N. R.).

Los Angeles County: **1**, Found with pyrrhotite, galena, and sphalerite in veins in schist, at the property of the Denver Mining and Milling Company, 12 miles from the mouth of Pacoima Canyon, Tucker (4) p. 318. **2**, Found as veins and stringers in quartz, 7 miles below the summit of Soledad Pass (New Pass), 90 feet above the creek bed, W. P. Blake (3) p. 81. **3**, Found with marcasite and sphalerite on Mill Creek, near the Monte Cristo mine, R. J. Sampson (10) p. 187.

Madera County: **1**, It was found in small masses at the Buchanan mine (sec. 33, T. 8 S., R. 18 E., M. D.), Aubury (1) p. 218. **2**, At the Ne Plus Ultra and others near Daulton, ibid. **3**, Chalcopyrite occurred as thin seams in massive pyrrhotite at the Heiskell (Fresno copper) mine (N. R.). **4**, Found also in the Minaret district, W. W. Bradley (9) p. 548, Erwin (1) pp. 66-71.

Marin County: **1**, It occurs with pyrite in a number of veins in serpentine, near Bolinas Bay (sec. 1, T. 1 N., R. 8 W., M. D.), Aubury (1) p. 143.

Mariposa County: **1**, Abundant as massive chalcopyrite with pyrite in the Green Mountain copper group (secs. 31, 32, T. 7 S., R. 18 E., M. D.). **2**, Pocahontas (sec. 14, T. 7 S., R. 17 E., M. D.). **3**, Baretta (T. 3 S., R. 16 E., M. D.). **4**, Near Hornitos (sec. 13, T. 3 S., R. 15 E., M. D.), and at other mines in small amounts. Aubury (1) pp. 206-215, (4) p. 268.

Mendocino County: **1**, Found with tetrahedrite at the Redwood Copper Queen (secs. 17, 20, T. 12 N., R. 13 W., M. D.), Aubury (1) p. 137.

Merced County: **1**, Small amounts occur in the Jose copper mine (sec. 4, T. 14 S., R. 9 E., M. D.) and Victor Bonanza (T. 13 S., R. 9 E., M. D.) Aubury (1) p. 146.

Modoc County: **1**, A little chalcopyrite is found in gold-quartz veins in the extreme northeast corner of the state, Hoag district (T. 47, 48 N., R. 15, 16 E., M. D.), Stines (2) p. 386, Averill (6) p. 453.

Mono County: **1**, It occurs sparingly on Blind Spring Hill, A. L. Ransome (2) p. 172. **2**, With scheelite, molybdenite, etc., on the slope of Bloody Mountain above Laurel Lake, Mayo (4) pp. 83, 84.

Napa County: **1**, High-grade chalcopyrite was found 13 miles south of Middletown (sec. 17, T. 10 N., R. 5 W., M. D.), Aubury (1) p. 140.

Nevada County: **1**, Chalcopyrite has been mined in the Spenceville district, Aubury (1) p. 164. **2**, Good masses of pure chalcopyrite, associated with arsenopyrite, galena, etc., are found in the Meadow Lake district, Wisker (1) p. 194. **3**, It was reported with pyrrhotite carrying platinum (?) values in the Liberty Hill district, in greenish siliceous rock, Hill (3) p. 8. **4**, It is widespread but not abundant in the Grass Valley mines, Lindgren (12) p. 118.

Placer County: Small amounts of chalcopyrite in pyrite are found at many localities in the county. Nowhere is it of much importance: Centennial (sec. 17, T. 12 N., R. 8 E., M. D.), Logan (4) p. 443; Valley View, Aubury (1) p. 174; Dairy Farm, Aubury (4) p. 208, and Baker (Whiskey Hill) near Lincoln, W. P. Blake (12) p. 290; Eclipse (sec. 17, T. 12 N., R. 8 E., M. D.), and Elder (sec. 4, T. 13 N., R. 8 E., M. D.), Aubury (4) pp. 207, 210; Colfax district (sec. 33, T. 15 N., R. 9 E., M. D.), C. A. Waring (4) p. 349.

Plumas County: **1**, Commercially valuable bornite-chalcopyrite ores have been mined at the Walker mine, Hanks (12) p. 94 and **2**, the Engels and Superior mines, Turner and Rogers (32) p. 377. These have been the leading copper producers in the state since 1915. **3**, It occurs with bornite and chalcocite at the Gruss copper mine, near Portola, Engineering and Mining Journal (25) p. 543. 4, It is present also in lesser amounts at a number of other properties, Logan (4) p. 470, Averill (8) pp. 93-95.

Riverside County: **1**, It is one of the minor minerals at the Crestmore quarry, Eakle (15) p. 352.

San Benito County: **1**, A little chalcopyrite is found on Lewis Creek (secs. 2, 3, 4, T. 19 S., R. 10 E., M. D., W. W. Bradley and Logan (7) p. 633. **2**, At Copper Mountain (T. 16 S., R. 7 E., M. D.), L. L. Root (4) p. 233.

San Bernardino County: Chalcopyrite occurs in small amounts in practically all of the mining districts in the county: Aubury (1) pp. 249-255, (4) pp. 325-329, Cloudman et al. (1) pp. 774-899, Tucker and Sampson (27) pp. 67, 69, (28) pp. 234-239.

San Diego County: **1**, Masses of chalcopyrite occur 8 miles east of Encinitas (T. 13 S., R. 3 W., S. B.), Aubury (1) p. 259. **2**, Also at the Barona copper claims (T. 14 S., R. 1 E., S. B.) 12 miles northeast of Lakeside, ibid. p. 260. **3**, The massive pyrrhotite of the Friday mine, 4 miles south of Julian, carries small amounts of chalcopyrite, with pentlandite and violarite, Calkins (2) p. 79, Hudson (1) p. 217.

San Luis Obispo County: Minor occurrences of chalcopyrite ores are scattered through the county; **1**, near Cayucas, and **2**, on Chorro Creek, Aubury (1) p. 148. **3**, A few miles south and west from Santa Margarita at the summit of the Santa Lucia Mountains, Logan (3) p. 686.

Santa Barbara County: **1**, Small deposits carrying chalcopyrite occur northeast of Los Olivos (sec. 5, T. 7 N., R. 29 W., S. B.), Huguenin (2) p. 735.

Santa Clara County: **1,** A little chalcopyrite occurred in the New Almaden quicksilver mine, Randol (2) p. 180. **2,** It is recorded from the Hooker Creek mine, 1 mile from Eva (T. 9 S., R. 1 W., M. D.), Hanks (14) p. 97, Huguenin and Castello (4) p. 184.

Shasta County: **1,** Chalcopyrite is the predominant mineral in the Shasta County copper belt, which includes the Iron Mountain, Bully Hill, Afterthought, Balaklala and other mines, Diller (7) pp. 126-132, (10) p. 12, Tucker (9) pp. 425-433. **2,** It was prominent in some of the veins in the Delta mine (T. 35 N., R. 5 W., M. D.), Ferguson (1) p. 72.

Sierra County: **1,** Chalcopyrite occurs in small amounts in the gold veins of the county, E. M. Boyle (3) p. 88, Averill (11) p. 17.

Siskiyou County: Some chalcopyrite, occasionally in considerable amount, is found, usually associated with pyrite and pyrrhotite, in nearly every ore deposit in the county. The occurrences are mostly in the western part of the county, near Callahan, Dutch Creek, Happy Camp, Honolulu, and other areas. The principal source of detailed information as to localities is Aubury (1) pp. 105-111, and (4) pp. 122-133.

Sonoma County: A few small occurrences are known from this county: **1,** Cornucopia mine (secs. 33, 34, T. 12 N., R. 9 W., M. D.), W. W. Bradley (1) p. 320; **2,** Sonoma copper mine half a mile east of Tyrone, where small crystals have been found (N. R.).

Tehama County: **1,** Pyrite and chalcopyrite form the ore of the California and Massachusetts copper mines (sec. 25, T. 27 N., R. 9 W., M. D.), Tucker (3) p. 261.

Trinity County: Chalcopyrite ores have been mined at a number of localities: **1,** Lambert group at the mouth of Rattlesnake Creek and **2,** on the Cold Fork of Indian Valley Creek, Aubury (1) pp. 118, 119; **3,** in the Copper Queen mine, Carrville district, MacDonald (2) p. 17; **4,** with considerable chalcanthite in the New River district, Aubury (4) p. 144; **5,** in the pyrrhotite mass at Island Mountain, S. M. B. (15710); **6,** at the Ralston mine (sec. 32, T. 35 N., R. 10 W., M. D.), Averill (10) p. 55.

Tulare County: **1,** Small amounts of chalcopyrite occur in the Mineral King area. **2,** Chalcopyrite is also found near Kearsarge Peak (sec. 34, 35, T. 14 S., R. 31 E., M. D.). **3,** 7 miles northeast of Visalia, Tucker (2) p. 908. **4,** In Round Valley 2½ miles east of Lindsay. **5,** With pyrrhotite on the north fork of the midlde fork, Tule River (secs. 30, 32, T. 19 S., R. 31 E., M. D.), ibid. p. 909. **6,** Also at the Hart (sec. 2, T. 15 S., R. 28 E., M. D.) and Powell (T. 19 S., R. 31 E., M. D.), properties, Franke (1) p. 435.

Tuolumne County: **1,** Considerable chalcopyrite ore was found at the Washington mine (secs. 20, 21, T. 2 N., R. 17 E., M. D.). **2,** It occurs at the Oak Hill mine, Aubury (4) pp. 250, 251. **3,** In the mines at Big Oak Flat, and **4,** at the Mann copper mine 3 miles south of Jamestown, and others (N. R.).

Ventura County: **1,** It occurs in the White Mule group (sec. 13, T. 8 N., R. 20 W., S. B.), in gold quartz veins with marcasite and pyrite, Tucker (10) pp. 231, 232.

Yuba County: **1,** Chalcopyrite is a minor constituent in the gold-quartz veins at the Golden Mary (W½ sec. 34, T. 19 N., R. 6 E., M. D.), C. A. Waring (4) p. 445. **2,** It occurs at the Ayer mine (sec. 35, T.

16 N., R. 5 E., M. D.), ibid. p. 424. 3, In the Dobbins district (sec. 23, T. 18 N., R. 7 E., M. D.), ibid. p. 447.

CHALCOTRICHITE

See cuprite

CHIASTOLITE

See andalusite

CHILE SALTPETER

See soda niter

CHLORITES

The chlorites are a group of soft micaceous alumino-silicates of iron and magnesium. The species below grade into one another by continuous variations in composition. The chlorites are common constituents of metamorphic rocks and as such are often referred to by group name. It is frequently impossible to distinguish variety, or even species, without extensive chemical and optical examination.

A common classification of the chlorite group with the ordinary specific (S) and varietal (V) names is as follows:

- Chlorite (undistinguished)
- Penninite (S)
  - Kämmererite (V)
  - Rhodophyllite (V)
  - Rhodochrome (V)
  - Pseudophite (V)
- Clinochlore (S)
  - Leuchtenbergite (V)
  - Kotschubeite (V)
  - Manganchlorite (V)
  - Sheridanite (V)
- Prochlorite (S)
  - Corundophilite (V)
  - Rumpfite (V)
  - Amesite (V)
  - Kossmatite (V)

CHLORITE

Sierra County: 1, Crystals of chlorite associated with magnetite as replacement of dolomite occur at the Sierra iron mine at Upper Spencer Lake, Durrell (p.c., '45).

CLINOCHLORE

Hydrous magnesium and aluminum silicate, $H_8Mg_5Al_2Si_3O_{18}$

Monoclinic. Plates, scaly, earthy, compact. Cleavage perfect basal. Pearly luster. Deep grass green, olive-green, rose-red. Streak greenish-white to uncolored. Plates are flexible but inelastic, thus differing from the micas. H. = 2-2½. G. = 2.65-2.78.

Practically infusible. Decomposed by boiling sulphuric acid. Gives water in a closed tube when intensely heated.

Clinochlore occurs as an alteration product of magnesium-iron minerals and is common in schists. *Kotschubeite* is a rose-red variety containing chromium, and is associated with chromite in serpentine rocks.

Amador County: 1, Specimens from near Jackson are reported as probably kotschubeite, Lindgren (2) p. 5, although the material may be kämmererite.

El Dorado County: **1**, Coarsely crystalline chlorite, probably clinochlore is found on the Stifle claim on Traverse Creek near Georgetown, Durrell (p.c., '44).

Fresno County: **1**, Large pseudo-hexagonal plates of clinochlore with some penninite occur in 1- to 6-inch veins (E½ sec. 11, T. 12 S., R. 23 E., M. D.) and also in road cuts along the highway on the north side of the north fork, Kings River, near Piedra, Durrell and Macdonald (1) p. 452. **2**, Clinochlore occurs as micaceous crusts of nodular masses near Humphreys (sec. 22, T. 11 S., R. 23 E., M. D.), Pabst (8) p. 582. **3**, Tabular crystals of clinochlore (3) as much as $\frac{5}{16}$ of an inch in size are reported to be associated with andradite garnet in White Creek near the Archer mine, Watters (p.c., '51), Murdoch (p.c., '54).

Los Angeles County: **1**, Chlorite, probably clinochlore, occurs with clinozoisite and tourmaline on the north side of Sierra Pelona Valley (center sec. 2, T. 5 N., R. 14 W., S. B.), Neuerburg (p.c., '44).

Placer County: **1**, Rose-red kotschubeite occurs on chromite in the serpentine of Green Valley on the American River below Towle, Lindgren (2) p. 904. Analysis by Melville, in Melville and Lindgren (1) p. 27.

Riverside County: **1**, Clinochlore occurs in pale-green flakes with idocrase in the limestone of the Wet Weather quarry at Crestmore, Eakle (15) p. 348, Woodford et al. (10) p. 370.

PENNINITE

Hydrous magnesium, iron, and aluminum silicate,
$H_8(Mg,Fe)_6Si_4O_{18}$ to $H_8(Mg,Fe)_5Al_2Si_3O_{18}$

Monoclinic. Plates, scales, scaly massive. Cleavage perfect basal. Pearly to vitreous luster. Color emerald green, grass green, violet, rose red. H. = 2-2½. G. = 2.6-2.85. Fusibility 5-5½. Completely decomposed by sulphuric acid.

Penninite is similar to clinochlore but has more iron in its composition. *Kämmererite* is a peach-blossom red variety associated with chromite. *Rhodochrome* is similar to kämmererite.

Alameda County: **1**, Reddish-violet kämmererite occurs with chromite on Cedar Mountain at the Mendenhall mine, A. F. Rogers (7) p. 380.

Amador County: **1**, Kämmererite (?) or kotschubeite occurs near Jackson, Lindgren (2) p. 5.

Calaveras County: **1**, Rather abundant kämmererite is found in the chromite ores of the Mayflower property (NW¼ sec. 9, T. 1 N., R. 13 E., M. D.), and in minor amounts in neighboring deposits, Cater (2) p. 50.

Del Norte County: **1**, Kämmererite with uvarovite has been observed coating chromite at the Camp 8 group (sec. 19, T. 16 N., R. 3 E., H.), J. E. Allen (2) p. 123. **2**, Kämmererite has come from the Brown mine at High Plateau (sec. 28, T. 18 N., R. 2 E., H.), Vonsen (p.c. '45).

El Dorado County: **1**, Kämmererite occurred with uvarovite at the Pilliken mine (sec. 21, T. 11 N., R. 8 E., M. D.), Averill (12) p. 90. **2**, Kämmererite has been found at Latrobe, S. M. B. (20511).

Monterey County: **1**, Kämmererite with uvarovite and chromite occurs west of King City, W. W. Bradley (26) p. 354.

Nevada County: **1**, Rhodochrome is abundant at the Red Ledge chrome mine near Washington (sec. 13, T. 17 N., R. 10 E., M. D.), E. M. Boyle (1) p. 77.

Placer County: **1**, Kämmererite occurs in chromite in Green Valley, above Dutch Flat, S. M. B. (9900). **2**, Shannon (3) p. 377, has analyzed

a pale grayish-lavender chromiferous chlorite from the mine of the Placer Chrome Company, 6 miles south of Newcastle.

San Benito County: **1,** Red kämmererite occurs on chromite associated with uvarovite at New Idria, Brush (1) p. 268. **2,** Coarse flakes of kämmererite occur in massive chromite near the headwaters of the San Benito River (SW¼ sec. 21 T. 18 S., R. 12 E., M. D.), Murdoch (p.c. '45).

Shasta County: **1,** Kämmererite coats chromite in the Little Castle Creek mine, near Dunsmuir (N. R.).

Siskiyou County: **1,** Kämmererite occurs with chromite and uvarovite at the Martin McKean mine near Callahan, Melhase (6) p. 23. **2,** Kämmererite occurs with uvarovite at the Youngs Valley group (T. 17 N., R. 5 E., H.), Rynearson and Smith (1) pp. 304, 306, J. E. Allen (2) p. 123. **3,** Kämmererite with uvarovite occurs north of Seiad (T. 46, 47 N., R. 11, 13 W., M. D.), Rynearson and Smith (1) pp. 304, 306, J. E. Allen (2) pp. 123, 124. **4,** Penninite is found with uvarovite at the Peg Leg mine, 14 miles southeast of Yreka, Symons (4) p. 101.

Tehama County: **1,** Kämmererite is found with chromite and uvarovite on North Elder Creek (T. 25 N., R. 7 W., M. D.), Rynearson (3) p. 200.

Yuba County: **1,** Kämmererite is found with uvarovite and chromite at the Red Ledge mine, Melhase (6) p. 23.

PROCHLORITE

Hydrous iron-magnesium and aluminum silicate, $H_8(Mg,Fe)_5Al_2Si_3O_{18}$ to $H_8(Mg,Fe)_4Al_2Si_3O_{18}$

Monoclinic. Scaly, foliated, granular, massive. Cleavage perfect basal. Pearly luster. Color green, blackish green, brown. Streak uncolored or greenish. H. = 1-2. G. = 2.78-2.96.

Like clinochlore in its reactions. Iron-rich varieties become magnetic after heating.

Prochlorite forms large flaky masses in schists.

Butte County: **1,** Prochlorite is a constituent of the schists at Forbestown, specimens coming from the Gold Bank mine, Irelan (4) p. 47.

Contra Costa County: **1,** Prochlorite was described and analyzed from the schists near San Pablo by Blasdale (1) p. 341.

CHLORITOID

Hydrous iron, magnesium, manganese, and aluminum silicate, $(Fe,Mg,Mn)_2Al_4Si_2O_{10}(OH)_4$

Monoclinic or triclinic. Foliated, massive, scales. Cleavage perfect basal. Plates flexible but not elastic. Pearly to vitreous luster. Color dark gray, grayish black, grass green. Streak uncolored or grayish. H. = 6½. G = 3.52-3.57. Infusible and insoluble. Gives much water in a closed tube.

Ottrelite is used as a synonym for chloritoid and as a name for varieties rich in manganese.

Inyo County: **1,** The variety ottrelite occurs in dark-green oblong plates in schists on the west side of the Panamint Range, 5 to 10 miles east of Ballarat. The mineral comprises a considerable proportion of the schists in localized areas, Murphy (4) p. 347.

Kern County: **1,** Dark-green chloritoid occurs abundantly in schists, 2½ miles northwest of Garlock, El Paso Mountains, Chesterman (p.c. '51).

Siskiyou County: **1,** A specimen of ottrelite schist has come from near Yreka, S. M. B. (12121).

CHLOROMAGNESITE

Magnesium chloride, $MgCl_2$

As an efflorescence. Color white. Soft. Soluble in water. Easily fusible.

Magnesium chloride exists in solution in the waters of some springs and lakes, but its solubility prevents it from forming as a mineral except in the driest places.

San Bernardino County: **1,** White efflorescences of chloromagnesite occur at Saratoga Springs, near the south end of Death Valley, G. E. Bailey (2) p. 106.

CHLOROPAL

Hydrous iron silicate, $Fe'''_4Si_4O_{10}(OH)_8 \cdot 5H_2O$

Compact massive, opal-like. Dull luster. Color pistachio green, greenish yellow. H. = 2½-4½. G. = 1.72-2.49.

Infusible. Heated intensely, becomes magnetic. Gives water in a closed tube. Gelatinizes with hydrochloric acid.

Nontronite is a varietal name for chloropal.

Alpine County: **1,** Chloropal is reported from this county, S. M. B. (18857).

El Dorado County: **1,** Nontronite altering to limonite occurs near Georgetown, S. M. B. (1613).

Inyo County: **1,** A yellowish-green mineral identified as a ferric silicate, doubtfully classed as chloropal, is reported from the Green Monster mine, 1½ miles north of Citrus (Kearsarge), A. Knopf (5) p. 120.

Kern County: **1,** Nontronite occurring as veinlets in garnet-pyroxene rock near Woody postoffice has been analyzed by Steiger, Larsen and Steiger (6) p. 4, R. C. Wells (3) p. 108, Storms (13) p. 635. **2,** It is briefly described (variety nontronite) from Kelso Creek near Weldon from a contact zone with scheelite, Hess and Larsen (17) p. 266.

Mariposa County: **1,** Nontronite is reported from Hites Cove, Hanks (15) p. 100.

Modoc County: **1,** A specimen S. M. B. (19569) from near Alturas is recorded, Hamilton (4) p. 129.

Mono County: **1,** Nontronite has been tentatively identified from oxidized scheelite ore bodies from the Black Rock mine in the Benton Range, Lemmon (6) p. 590.

Nevada County: **1,** S. M. B. (8215) is chloropal from the Blue Gravel lead.

Placer County: **1,** Reported from Bath, Hanks (15) p. 100.

Riverside County: **1,** Nontronite from the new city quarry, 2 miles south of Riverside, occurs as an alteration product of pyroxene in a labradorite-hedenbergite rock. The material is greenish yellow, earthy, fibrous and micaceous, Richmond (1) p. 726. **2,** Also at Crestmore, Woodford et al. (10).

CHONDRODITE

Magnesium fluosilicate, $Mg_5(SiO_4)_2(OH,F)_2$

Monoclinic. Usually in grains. Vitreous luster. Color yellow to brown. H. = 6-6½. G. = 3.1-3.2.

Infusible. Soluble with gelatinization.

Riverside County: **1**, From Crestmore this mineral occurs in two environments: (a) in contact rock with brucite and periclase as rounded, but somewhat tabular colorless crystals, A. F. Rogers (19) p. 583, (31) p. 463, Woodford et al. (10) p. 367; (b) more rarely in dark-green crystals up to 1 millimeter in size, in contact rock in Lone Star quarry, Woodford et al. (10) p. 367. **2**, Chondrodite was also found in the old city quarry, Riverside, A. F. Rogers (19) p. 582. **3**, Deep amber grains of chondrodite are rather abundant in some of the contact zone limestones of the Jensen quarry, Murdoch (p.c. '47).

San Bernardino County: **1**, It is reported from the limestone quarries at Colton, Eakle (15) p. 333.

CHROMITE

Oxide of chromium and iron, $FeCr_2O_4$

Isometric. In octahedrons. Generally massive; fine granular to compact. Brittle. Metallic luster. Color black. Streak brown. H. = 5½. G. = 4.1-4.9.

Infusible. Gives an emerald-green bead of chromium with borax. Insoluble.

Magnesium-chromite is a common variant, in which magnesium in part replaces chromium. *Trautwinite* is an impure chromite.

Chromite is an exceedingly widespread mineral in the state, notably in the Coast Ranges from Santa Barbara County northward, especially in the serpentine areas, Diller (18). Distribution of some of the localities is described in Bulletin 76 of the State Division of Mines, W. W. Bradley et al. (4). Chromite occurs commonly as disseminated grains in basic and ultrabasic rocks, as irregular boulder-like masses, and seldom as individual crystals.

Alameda County: **1**, Massive chromite occurs in many mines in the Cedar Mountain district, 16 miles southeast of Livermore, Hanks (12) p. 136, (15) p. 100, Aubury (3) p. 267, W. W. Bradley et al. (4) p. 115. Analysis by Kramm (1) p. 341.

Amador County: **1**, It is found near Jackson, 1 mile south of Mountain Spring House, Hanks (12) p. 136, (15) p. 100. **2**, Some ore was shipped from properties near Ione (sec. 34, T. 6 N., R. 10 E., and sec 2, T. 5 N., R. 10 E., M. D.), W. W. Bradley et al. (4) p. 116. **3**, Shipments have also been made from various properties occurring in serpentine on Cosumnes River 8 miles northeast of Carbondale (secs. 6, 29, T. 7 N., R. 10 E., M. D.), Hanks (12) p. 117. **4**, Many small deposits of chromite occur throughout the county (T. 5, 6, 7, 8, N., R. 10 E., M. D.), Cater (2) pp. 33-38.

Butte County: Placer chromite is common and has been reported by Engineering and Mining Journal (12) p. 1259, (23) pp. 511, 597, 807, Diller (14) p. 11, Averill (13) p. 71. Deposits in situ are very numerous, in small pockets in serpentine. Localities are mentioned or described by Hanks (12) p. 136, Aubury (3) p. 267, W. W. Bradley et al. (4) pp. 105, 118-121.

Calaveras County: Chromite is widespread in this county, mostly in lode but occasionally in placer deposits. Occurrences are reported from **1**, Tower Ranch, 9 miles east of Milton, and Wright Ranch in Salt Springs Valley, 10 miles northeast of Milton, by Aubury (3) p. 267. **2**, From the Big Pine chrome mine, (sec. 20, T. 4 N., R. 11 E., M. D.), Aubury (3) p. 267. **3**, Near Murphys and at Campo Seco, Hanks (12)

p. 136. **4,** 5 miles southeast of Valley Springs and 4 miles north of Copperopolis on the road to Milton, Tucker (14) pp. 55, 56. **5,** Reported by W. W. Bradley et al. (4) p. 121, 8 miles southwest of Angels Camp (secs. 3, 7, 10, T. 2 N., R. 12 E., M. D.). **6,** From 4 miles west of Fostoria (secs. 23, 30, T. 5 N., R. 10, 11 E., M. D.) ibid. p. 122. **7,** From 14 miles east of Milton Station (sec. 15, T. 2 N., R. 12 E., M. D.) ibid. p. 123. **8,** From 10 miles northeast of Angels Camp at True Blue mine, ibid. p. 123. **9,** Large masses were reported from south side of San Diego Gulch near Noble copper mine, J. R. Browne (4) p. 225. Other occurrences too numerous to list are all in the serpentines of this county. Details of location of the many chromite deposits, mostly small, in the county (T. 1, 2, 3, 4, 5 N., R. 10, 11, 12, 13 E., M. D.), are given by Cater (2) pp. 33-58.

Colusa County: **1,** Minor amounts were shipped from Chrome Wonder mine, near Stonyford. W. W. Bradley et al. (4) p. 123. **2,** Near Wilbur Springs, ibid. p. 123. **3,** From 1½ miles northwest of Cook Springs (T. 16 N., R. 6 W., M. D.) ibid. p. 124.

Contra Costa County: **1,** Chromite prospects were located in T. 1 N., R. 1 W., M. D., L. L. Root (5) p. 12, and **2,** occurrences have been reported from 1 mile northeast of North Peak, in the Mount Diablo range; **3,** also from east of San Antonio in the Contra Costa Hills, J. D. Whitney (7) p. 19.

Del Norte County: **1,** Black sands along Smith River carry chromite, Hanks (12) p. 136, and **2,** beach sands near Crescent City carry abundant chromite, Horner (1) p. 35. **3,** Lode occurrences are very numerous. Some important deposits occur in T. 15, 16, 17, 18 N., R. 2, 3 E., M. D.; these and other localities are described by Maxson (1) pp. 123-160 and J. C. O'Brien (1) pp. 77-84. Other references to chromite in this county are Hanks (12) p. 136; McGregor (1) p. 167; Aubury (1) p. 114, (3) p. 267, 268; W. W. Bradley et al. (4) p. 125, and Diller (18) p. 32.

El Dorado County: Serpentine rocks in this county carry chromite in disseminated irregular masses. Concentrations from which some sample shipments of ore were made, are found in some parts of the county. Many localities are grouped about the following places: Volcanoville, Cummings, Newcastle, Clarksville, Georgetown and Folsom, W. W. Bradley et al. (4) pp. 132-143; near Coloma and Latrobe, W. W. Bradley et al. (4) p. 131, Hanks (12) p. 136, (15) p. 100; a 15-inch vein in slate is reported by Fairbanks (9) p. 479 from near the Fort Yuma mine. Occurrences in the Pilliken area (sec. 28, T. 11 N., R. 8 E., M. D.) are described by Page et al. (1) p. 433, and are mentioned by W. W. Bradley et al. (4) p. 137, and Tucker (3) p. 274. Analysis of chromite from the Donnelly deposit, 10 miles northeast of Folsom (sec. 21, T. 11 N., R. 8 E., M. D.) is given by W. W. Bradley et al. (4) p. 133.

Fresno County: Deposits of chromite occur in the Mount Diablo Range in the western part of the county. Many occurrences are mentioned in W. W. Bradley et al. (4) pp. 144-145 and Goldstone (1) p. 189. J. D. Whitney (7) p. 59 reported chromite as a "* * * block 4′ x 7′4″ x 5′6″ thought to be silver ore at first * * *" from near the New Idria mine.

Glenn County: Occurrences are found **1**, near Millsaps (sec. 25, T. 22 N., R. 7 W., M. D.), Aubury (3) p. 268 and W. W. Bradley et al. (4) p. 198. **2**, On Big Stony Creek (T. 19 N., R. 6 W., M. D.) J. H. Rogers (1) p. 324. **3**, Claims are located 30 miles west of Orland (sec. 3, T. 22 N., R. 7 W., M. D.), W. W. Bradley et al. (4) p. 147. **4**, Chromite also occurs near Newville, Boalich (1) p. 25. **5**, 19 miles from Fruto (T. 19, 20 N., R. 5, 6 W., M. D.) Mining and Scientific Press (39) p. 454.

Humboldt County: **1**, Occurrences in sec. 24, T. 10 N., R. 5 E., and secs. 11, 13, T. 11 N., R. 4 E., H., have been recorded by J. C. O'Brien (1) p. 78. **2**, Float was reported from Hoopa Indian Reservation and Little Wilder Creek, Averill (10) pp. 505, 506. **3**, Ore was shipped from deposits on Horse Mountain, 25 miles northeast of Eureka (sec. 33, 34, T. 6 N., R. 4 E., H.) W. W. Bradley et al. (4) p. 148.

Kings County: **1**, Float chromite has been found in the serpentine area at Table Mountain, W. W. Bradley (2) p. 527.

Lake County: Two general areas have the largest number of reported prospects. **1**, east of Middletown, (T. 10, 11, 12 N., R. 6, 7 W., M. D.), in decomposed serpentine, W. W. Bradley (1) p. 204, W. W. Bradley et al. (4) p. 148, 149; **2**, in sec. 36, T. 19 N., R. 10 W., M. D., near Hullville, W. W. Bradley (1) p. 204, Laizure (9) p. 54. The serpentine rocks of the county carry disseminated chromite in many other areas.

Los Angeles County: **1**, Chromite is reported to occur 13 miles north of Saugus in Bouquet Canyon, in serpentine, Tucker (13) p. 288. **2**, Reports of occurrences from near Acton and Harold in Soledad Canyon, F. J. H. Merrill (2) p. 471, W. W. Bradley et al. (4) p. 151, are undoubtedly due to mis-identification of ilmenite which is so abundant as float and lode in this section.

Madera County: **1**, Chromite is found near Madera in masses coated with zaratite. S. M. B. (13414).

Marin County: **1**, Chromite is reported from the Maillard Ranch in San Geronimo Township, 8 miles northwest of San Rafael, Watts (2) p. 253.

Mariposa County: **1**, Chromite ore was shipped from Purcell-Griffin mine, southeast of Coulterville near Pleasant Valley Station, W. W. Bradley et al. (4) p. 151. **2**, Many small chromite deposits are in the region covered by T. 2 S., R. 16 E., M.D., Cater (1) pp. 1-32.

Mendocino County: **1**, Chromite coated with uvarovite garnet is found 12 miles north of Willits, Melhase (6) p. 23, S. M. B. (12248). **2**, Many claims have been filed in vicinity of Big and Little Red Mountains (T. 24 N., R. 16 W., M. D.), W. W. Bradley et al. (4) p. 152. **3**, 1½ miles west of Ukiah (sec. 24, T. 15 N., R. 13 W., M. D.). McGregor (1) p. 312. **4**, Several occurrences in the hills west of the Russian River are reported, Aubury (3) p. 268, and Crawford (2) p. 49. **5**, The serpentine belts in the county carry chromite in many other places.

Monterey County: **1**, Chromite is common in the serpentine belts of this county, reported occurrences being principally in the vicinity of Parkfield, Hanks (12) p. 136, W. W. Bradley (1) p. 527, W. W. Bradley and Waring (6) p. 599—analysis by Goldsmith (2) p. 365.

Napa County: **1**, Several prospects are reported on the Knoxville road 12 miles from Middletown (secs. 32, 36, T. 10 N., R. 5 W., M. D.), Hanks (12) p. 136, Crawford (2) p. 50, W. W. Bradley et al. (4) p.

156, 157, Boalich (4) p. 158. **2**, 900 tons of chromite were shipped from Graves Ranch mine, 8 miles northwest of Monticello, Boalich (4) p. 158.

Nevada County: Chromite is found in the concentrates of many gold mines in this county. **1**, Fine octahedrons are reported to occur in serpentine near Indian Springs (N. R.). **2**, High grade ore has been shipped from the Red Ledge and other mines, near Washington (T. 16, 17 N., R. 8, 9, 10 E., M. D.). The ore of the Red Ledge is commonly coated with uvarovite and kämmererite, J. B. Trask (1) p. 25, Hanks (12) p. 137, E. M. Boyle (1) p. 63, Averill (11) p. 141.

Placer County: Chromite is widespread in serpentine in this county. Many occurrences have been reported. Some references are: Hanks (12) p. 137, (15) p. 441; Aubury (3) p. 268; W. W. Bradley et al. (4) pp. 160-163; C. A. Waring (4) p. 326; Logan (4) p. 441; E. Sampson (3) p. 107; Averill (13) p. 75. **1**, 7 miles southeast of Newcastle nodular masses coated with penninite, kämmererite, and good crystals of uvarovite are found, Melhase (6) p. 23. **2**, In Green Valley, 9 miles southeast of Towle, chromite occurs with uvarovite and clinochlore (kotschubeite) Lindgren (2) p. 5, Melville and Lindgren (1) p. 27.

Plumas County: **1**, Chromite occurrences in this county are similar to those of the other Mother Lode counties, in serpentines and as concentrates in placers. References are found in Hanks (15) p. 101; Turner (12) p. 590, (17) p. 6; W. W. Bradley et al. (4) p. 165, 166; E. M. Boyle (2) p. 54; J. C. O'Brien (1) p. 79; Logan (21) p. 85.

Sacramento County: Chromite is reported **1**, in black sands of Sacramento River bars (N. R.); **2**, from 7 miles east of Folsom on the South Fork of the American River, Hanks (12) p. 137.

San Benito County: **1**, Stream placers near Hollister have yielded chromite boulders with zaratite (?) coatings, W. W. Bradley et al. (4) p. 166. **2**, Chromite also occurs in the serpentine belts near Hernandez, L. L. Root (4) p. 228. **3**, Southeast of New Idria, Aubury (3) p. 269, W. W. Bradley and Logan (7) p. 630.

San Bernardino County: **1**, Chromite is reported from 28 miles west of Hesperia, Diller (14) p. 9, Dolbear (6) p. 358. (The writers suspect that this is another erroneous reference, based on the widespread ilmenite occurrences of the San Gabriel Mountains.)

San Francisco County: **1**, Chromite is found in the sands of Ocean Beach below outlet of Lake Merced, S. M. B. (686), Hanks (12) p. 137.

San Luis Obispo County: Chromite occurs widespread in the serpentine of the county. **1**, Many marginal occurrences that have produced ore shipments from time to time are located around San Luis Obispo. Descriptions of some properties and localities are found in Hanks (12) p. 137; Irelan (3) p. 531; Crawford (1) p. 37; Aubury (3) p. 270; Harder (2) p. 167; analysis by Pemberton (1) p. 241.

San Mateo County: **1**, Scattered masses of chromite occur near Crystal Springs Lake west of San Mateo on the Pacific slope of the redwoods, in serpentine, Hanks (12) p. 137, Huguenin and Castello (4) p. 172.

Santa Barbara County: **1**, A small deposit of chromite occurs in the hills southwest of Point Sal, Huguenin (2) p. 735. **2**, Chromite also occurs in T. 8 N., R. 30 W., M. D. near Santa Ynez, Tucker (4) p. 387.

Santa Clara County: As in other counties of the Coast Ranges, chromite occurs in the widespread serpentine rocks. Localities are mentioned by Hanks (12) p. 137, Irelan (3) p. 549, Crawford (1) p. 38,

Carey and Miller (1) p. 162, Diller (20) p. 666, and Huguenin and Castello (4) p. 183, Davis and Jennings (6) p. 39.

Santa Cruz County: **1**, 70 tons of chromite were produced from this county in 1925, Furness (1) p. 139.

Shasta County: **1**, On Little Castle Creek (sec. 2, T. 38 N., R. 4 W., M. D.) occurs what is described as the largest chrome ore body on the Pacific Coast, at the Brown mine, 3 miles south of Dunsmuir, G. C. Brown (2) p. 755, W. W. Bradley et al. (4) pp. 183-188, and Diller (16) p. 28. **2**, There are also deposits on Shotgun Creek (T. 37 N., R. 4 W., M. D.) in serpentine, Crawford (2) p. 50. **3**, On Boulder Creek, 4 miles west of Gibson (sec. 33, T. 37 N., R. 5 W., M. D.), Mining and Scientific Press (40) p. 66. **4**, High-quality ore is reported 3 miles east of Sims Station (secs. 13, 24, T. 37 N., R. 5 W., M. D.), McGregor (1) p. 638, and Aubury (3) p. 270. **5**, Occurrences are mentioned near Round Bottom (sec. 5, T. 26 N., R. 10 W., M. D.), J. C. O'Brien (1) p. 81.

Sierra County: **1**, Dozens of placer and lode prospects have been explored in this county. Specific references are Hanks (1) p. 137; Crawford (1) p. 38, (2) p. 50; Turner (14) p. 8; Aubury (3) p. 271; E. M. Boyle (3) p. 29; Averill (11) pp. 14-16, (13) p. 76.

Siskiyou County: Chromite is widespread in serpentine rocks of the county. Prospects are too numerous to be recorded. Details, including an analysis of a chromite ore of unusual structure from Seiad Creek near junction with Klamath River (sec. 33, T. 47 N., R. 11 W., M. D.) appear in W. D. Johnston Jr. (1) pp. 417-427. Other occurrences are described by: Hanks (12) p. 137; Aubury (3) p. 272; W. W. Bradley et al. (4) p. 190; Laizure (1) p. 530; Logan (8) p. 424; J. C. O'Brien (1) p. 82. For additional reference for numerous small occurrences throughout the county, see J. C. O'Brien (4) p. 419.

Solano County: Chromite is reported **1**, from near Fairfield S. M. B. (2772), Hanks (12) p. 137, and **2**, from near Culver-Baer quicksilver mine, Boalich (4) p. 248.

Sonoma County: This county is underlain in a large measure by the Franciscan serpentine rocks, in which chromite is widespread. Occurrences are reported from dozens of localities: Tyson (1) p. 19; Hanks (12) p. 137; Crawford (1) p. 38; W. W. Bradley (1) p. 319; W. W. Bradley et al. (4) pp. 201-203; Huguenin and Castello (1) p. 248; L. L. Root (4) p. 333; Laizure (9) p. 56.

Stanislaus County: **1**, Small deposits from which some ore has been shipped occur in Arroyo del Puerto, W. W. Bradley et al. (4) p. 204, Hawkes and Wheeler (1) p. 1950. **2**, 1 mile east of Camp Jones, Engineering and Mining Journal (23) p. 807.

Tehama County: Large deposits of chromite occur on the North Fork of Elder Creek (sec. 16, T. 25 N., R. 7 W., M. D.) and are described by several writers: Crawford (1) p. 38; Aubury (3) p. 121; W. W. Bradley et al. (4) pp. 206-209; Tucker (3) p. 260; L. L. Root (4) p. 12; J. C. O'Brien (1) p. 84. For additional reference to occurrences throughout the county, see J. C. O'Brien (3) pp. 186, 187.

Trinity County: **1**, Relatively unimportant but numerous occurrences are described by G. C. Brown (2) p. 877; Engineering and Mining Journal (23) p. 511; L. L. Root (4) p. 12; J. C. O'Brien (1) p. 84.

Tulare County: **1,** Several prospects are reported near Porterville and Lindsay in and about T. 19 S., R. 27 E., M. D., Hanks (12) p. 138; W. W. Bradley et al. (4) p. 213; and Tucker (3) p. 907.

Tuolumne County: The serpentine of the county carries much disseminated chromite. **1,** Localities are mentioned by Hanks (12) p. 138; Turner and Ransome (15) p. 7; W. W. Bradley et al. (4) p. 213; Averill (13) p. 76. **2,** Additional localities (mostly small), in the county are in the area T. 1, 2, S., 1 N., R. 13, 14, 15 E., M. D., Cater (1) pp. 1-32, Logan (23), p. 52.

Yuba County: **1,** Placer chromite occurs in black sands along the Yuba River (N. R.). **2,** Also found at the Woodleaf (Woodville) Canyon mine, Mining and Scientific Press (39) p. 569.

*CHROMRUTILE, 1928

Perhaps chromian rutile mixed with a silicate

Tetragonal. Crystals prismatic or equant. Color black, brilliant.

Nevada County: **1,** Chromrutile, a new mineral from California, occurs as small brilliant black crystals with kämmererite on chromite at the Red Ledge mine in the Washington district, Gordon and Shannon (1) p. 69, W. W. Bradley (29) p. 69, Palache et al. (10) p. 560.

Analysis

CaO	MgO	Al_2O_3	Fe_2O_3	Cr_2O_3	SiO_2	TiO_2	Ign.
0.76	5.52	0.57	0.80	16.61	5.51	69.71	1.48 = 100.96

CHRYSOBERYL

Oxide of beryllium and aluminum, $BeAl_2O_4$

Orthorhombic. Usually twinned crystals. Striated faces. One cleavage distinct. Brittle. Vitreous luster. Color grass green, yellowish green, greenish brown. Streak uncolored. H. = 8½. G. = 3.5-3.84.

Infusible and insoluble. Fine powder, when intensely heated on charcoal, moistened with cobalt nitrate and reheated, assumes a sky-blue color.

Butte County: **1,** Chrysoberyl is reported to have been found near Stanwood and at Big Bar (N. R.)

CHRYSOCOLLA

Hydrous copper silicate, $CuSiO_3 \cdot 2H_2O$

Cryptocrystalline. Opal-like, earthy, incrustations. Vitreous to dull luster. Color bluish green, turquoise blue. Streak white. H. = 2½-3. G. = 2-2.24.

Infusible, but soluble in nitric acid without forming a jelly. A blue solution is obtained by adding ammonia to the nitric-acid solution. Can be reduced to metallic copper by fusing on charcoal with sodium carbonate. Darkens and gives water in a closed tube.

Small amounts of chrysocolla occur in most, if not all, of the copper districts of the state, in the oxidized zone of the ore bodies, as incrustations, coatings, and disseminated grains. It is also common in other types of ores, and is often an associate of other minerals when minute amounts of copper were in the mineralizing solutions. Only occurrences of mineralogical interest are specifically noted here.

Inyo County: **1,** Pseudomorphs of chrysocolla after calcite have been described from the Reward mine 2 miles east of Manzanar, A. F. Rogers

(3) p. 20, A. Knopf (5) p. 118. **2**, Pseudomorphs of chrysocolla after cerussite are reported from the Aries mine in the Cerro Gordo district, Kunz (24) p. 101.

Kern County: **1**, Beautiful crystals (presumably pseudomorphs) mistaken for turquoise are supposed to occur near Randsburg, Kunz (24) p. 101.

Mono County: **1**, Chrysocolla was formerly the chief ore mineral of deposits now worked for gold and silver, at the Goleta Consolidated mine on Copper Mountain, Aubury (1) p. 243.

Plumas County: **1**, Banded chrysocolla and malachite are important ore associates at the Engels mine in Copper Canyon, Kunz (24) p. 102, Graton and McLaughlin (4) p. 20.

San Bernardino County: **1**, Chrysocolla is the principal mineral in the Horn mine (sec. 32, T. 2 N., R. 21 E., S. B.), Wright et al. (5) p. 64. **2**, It also occurs abundantly in the Bagdad Chase gold mine, ibid. p. 60. **3**, It is abundant, with malachite, at the Blue Bell mine, 7 miles west of Baker (sec. 27 (?), T. 14 N., R. 7 E., S. B.), ibid. p. 101.

Santa Clara County: **1**, A. F. Rogers (3) p. 20 has described pseudomorphs of chrysocolla after cuprite from the Santa Margarita mine near New Almaden.

Chrysocolla is mentioned from other counties. Some references are: Humboldt, Laizure (3) p. 306; Imperial, Henshaw (1) p. 185; Inyo, Hanks (12) p. 139; Ball (2) p. 211, Zalinski (1) p. 81, A. Knopf (5) p. 119, 120, C. A. Waring (4) p. 69, Tucker and Sampson (25) p. 399; Los Angeles, Storms (4) p. 244; Madera, Goudey (1) p. 8; Mariposa, J. R. Browne (4) p. 213, Aubury (1) p. 213; Mendocino, S. M. B. (15689); Mono, Hanks (12) p. 139, A. L. Ransome (2) p. 190; Nevada, Lindgren (4) p. 201; Riverside, Orcutt (2) p. 901; San Benito, Louderback and Blasdale (5) p. 359; San Bernardino, Hanks (12) p. 139, Lindgren (1) p. 724, Crawford (1) p. 69, (2) p. 60, Storms (8) p. 579, Aubury (1) p. 255, Kunz (24) p. 102, Tucker and Sampson (17) p. 344; Tulare, S. M. B. (14169).

CHRYSOLITE

See olivine

CHRYSOPAL

See opal

CHRYSOPRASE

See quartz, chalcedony

CHRYSOTILE

See serpentine

CINNABAR

Mercuric sulphide HgS

Hexagonal-rhombohedral. Small crystals common; also granular massive. Cleavage perfect prismatic. Adamantine luster. Color cochineal red, to brownish red and lead gray. Streak scarlet. H. = 2-2½. G. = 8.0-8.2.

Volatilizes completely and yields a sulphur odor on heating before the blowpipe.

Cinnabar was known in the state long before the discovery of gold, and the old mine at New Almaden had been in operation when Lyman

(2) p. 270 visited it in 1848. The most important quicksilver deposits lie in the Coast Ranges, extending from Del Norte County to Santa Barbara County. Those in the Sierra Nevada are of minor value. Lake, Napa, Santa Clara, and San Benito counties have been most important in the mining of cinnabar.

The quicksilver deposits of California have been described in Monograph XIII of the United States Geological Survey, Becker (4), and Bulletin 78 of the State Division of Mines, W. W. Bradley (5). The important producing areas are briefly described.

Lake-Napa-Sonoma area: The Mayacmas-Sulphur Bank districts include hundred of occurrences of cinnabar as well as other less important mercury minerals. The significant geological facts regarding occurrence and mineralogy, are described by C. P. Ross (3) and summarized as follows (pp. 327-328) :

"The Mayacmas and Sulphur Bank quicksilver districts, in northern California, have been active intermittently since the fifties and together have yielded about half a million flasks of quicksilver—more than a fifth of the total production of the State. Both districts are currently productive, * * *.

"In both districts the oldest formation is the Franciscan, whose beds are greatly deformed and are locally metamorphosed. Much ultrabasic rock, which has mainly been converted to serpentine, has been intruded into the Franciscan formation, most of it in irregular but more or less sill-like masses. The serpentine has locally been further changed to a silica-carbonate rock. Other intrusive rocks occur in small amount. The Franciscan formation and the intrusive rocks are overlain by Pliocene and later volcanic rocks.

"Most of the quicksilver deposits lie near the footwalls of the serpentine bodies, where they may be enclosed in serpentine, in silica carbonate rock, or in the Franciscan formation ; but the largest deposit, the Oat Hill, is in the Franciscan far fro any exposed serpentine. Some deposits are in younger intrusive rocks, and a few are in Recent lava. The ore is localized where relatively abundant openings have been accessible to the solutions. Concentration under impermeable bodies has locally aided in the formation of ore shoots, but in several mines no evidence of such a process has been recognized. Deposition may have been confined to the zone in which ascending solutions of magmatic origin mingled with ground water. This zone, though geologically shallow, probably extends beyond the depths to which it would be profitable to mine ore shoots that are so small and erratically distributed as those hitherto found in the area."

Santa Clara-San Benito area: Santa Clara and San Benito counties carry the two most famous cinnabar properties of the state—the New Almaden and the New Idria mines. The New Almaden, oldest of the many prospects now known in the Coast Ranges, is the oldest from which production has come. The New Idria, located farther south, though some 80 miles distant, has a similar geologic setting.

New Almaden, W. W. Bradley (5) p. 154

"The first known occurrence of quicksilver within the area of the United States, was that found at the New Almaden mine in Santa Clara County in 1824 by Antonio Suñol and Louis Chaboya. Though some occurrences had apparently been earlier noted in Mexico, the New Almaden was the first producing quicksilver mine in North America. Suñol and Chaboya built a mill nearby and endeavored to extract silver from the cinnabar. Late in 1845, the ore was shown to Andreas Castillero [Anonymous (5)], a Mexican officer, who identified it as cinnabar, and under whose direction development work was immediately begun. Gun barrels were utilized as their first retorts. The output was small, however, until after California became part of the United States, since which time more than a million flasks have been produced in this county, * * * the greatest portion of which came from the New Almaden mine * * *

"The quicksilver deposits of Santa Clara County are confined, with one exception, to what is known as the New Almaden district. This district lies east of south from San Jose, extending from the northeasterly foothills of the Gabilan Range on the west to the low foothills that lie between Coyote and Dry Creeks on the east. It also embraces the Santa Teressa Hills, a low spur ridge which lies between and in general parallel to the other two. The principal deposits are 8 to 13 miles from San Jose, on the ridge which forms the southwestern boundary of the Santa Clara Valley at this place, having a general NW-SE direction, and locally called the New Almaden Ridge.

"The geology of this district and particularly of the New Almaden Ridge and its orebodies has been described in considerable detail by various writers, especially by Becker (4) and by Forstner (1) p. 169, the latter of whom says:

'The three ridges in which the deposits occur are to a great extent formed by serpentine, especially the two first named. The serpentine is associated with metamorphic sandstone and jaspilites. Large bodies of croppings can be found in each of these ridges, having also a general northwestern trend, but not coinciding with the backbone of the ridges.

'In the New Almaden ridge the most extensive orebodies have been found in and close to Mine Hill, the highest peak of the ridge, lying in its southeastern part. From this point going northwestward the croppings, while not continuous, can be traced along the ridge into the territory of the Guadalupe mine, a distance of about 3½ miles. At the surface the serpentine shows in large detached bodies surrounded by the sandstones and shales of the Franciscan series and having a general northwestern trend. This general direction of the serpentine exposures is important in connection with its occurrence underground, proven in the New Almaden mine. The line of ore croppings runs from Mine Hill to the American shaft, passing about 600 feet southwest of the Randol shaft. The underground workings in this territory have shown that the fissures wherein the orebodies have formed have invariably a serpentine footwall; hence the serpentine must be considered to occur underground in a continuous body through this entire territory and to be in places covered by overlying sandstones and shales. Southwest of Capitancillos Creek lies another parallel exposure of serpentine, contiguous to which the outcrops of the Costello mines are found. The Santa Teresa and Bernal mines are located in the serpentine of the Santa Teresa hills, and the North Almaden or Silver Creek mine close to those of the most northern ridge. In the latter a great part of the serpentine is very highly altered by silicification, as also the sandstones, a great portion of the rocks being jaspilites. The western slope of the adjoining Mount Diablo range is nearly exclusively formed of shales.' "

New Idria, R. G. Yates and Hilpert (2) p. 12

"Most of the quicksilver deposits described in this report lie in a fairly compact group about Panoche Valley in central San Benito County, California. One mine, the Mercy, is 5 miles north of this valley in northwestern Fresno County, and another, the Cerro Gordo, is about 9 miles to the west. Quicksilver was discovered in the region about 1859. Since then mining has been sporadic and the total output of quicksilver small. Discoveries since 1938 reawakened interest in the district and 1,741 flasks of quicksilver were produced between 1938 and 1944. This brought the total known production of the district to about 3,840 flasks.

"The quicksilver deposits are in a part of the Diablo Range characterized by northwestward-trending folds and by faults of diverse trends. Sedimentary rocks involved in these structures range in age from Jurassic to Recent, and the movements that produced the structures were probably recurrent during that time. Intrusive and extrusive igneous rocks formed at several periods. All but two of the quicksilver deposits are in the Jurassic Franciscan formation, which is the oldest, most widespread, and most diverse group of rocks in the area. Although the quicksilver deposits are of late Tertiary age, none have been found in the Tertiary rocks, and only two have been found in the Cretaceous rocks.

"The quicksilver deposits consist of irregular veins and disseminations of cinnabar or metacinnabar in silicified or kaolinized sandstone and fault breccia, and silica-carbonate rock formed by the hydrothermal alteration of serpentine. Prominent fault zones enclose, or are near, all the deposits except one. Most of the orebodies are irregular and of little horizonal or vertical extent and their positions and forms were controlled by minor faults and fractures or by the character of the wall rock. The deposits are characteristically spotty, consequently the grade of the ore varies between wide limits. Ore reserves in the district are not amenable to measurement. It is probable, however, that a small but wavering production will be maintained as long as the price of quicksilver exceeds $175 a flask.

"Further prospecting may disclose new deposits. Their universal association with faults and zones of hydrothermally altered rocks should be a valuable guide in prospecting."

San Luis Obispo area: Many prospects occur concentrated north of San Luis Obispo in the Coast Ranges east of and between Cambria and

San Simeon. The deposits are described by Eckel, Yates, and Granger (1) p. 515 as follows:

"Most of the deposits * * * lie within an elongated area of about 75 square miles in northwestern San Luis Obispo County. Other deposits, most of them small, are scattered southeastward from southwestern Monterey County to the southern border of San Luis Obispo County. Quicksilver was first discovered in the region in 1862. Though mining since then has been intermittent, the output has been relatively large during or immediately after the periods of high quicksilver prices. Monterey County has produced very little quicksilver, but San Luis Obispo County, which ranks sixth among the quicksilver-producing counties of the State, produced 69,264 flasks between 1876 and the end of 1939, 70 percent of which came from the Oceanic and Klau mines.

"All but one of the known quicksilver deposits are in or closely associated with the Franciscan formation, of Jurassic (?) age. This formation, embodying the oldest and most widely distributed group of rocks in the mapped areas, consists mainly of highly contorted and metamorphosed shale, sandstone, and conglomerate and is overlain by Cretaceous and Tertiary sediments. Extrusive and intrusive igneous rocks, most of them basic in composition, were formed at several periods after the Franciscan formation was deposited. Many of the intrusive bodies are now represented by serpentine.

"This part of the Coast Range province is characterized by numerous strong, complex, northwestward-trending fault zones, many of which have been intermittently active since late Jurassic time. Bodies of silica-carbonate rock (quicksilver rock), composed of dense quartz and mixed carbonates, were formed in many places by solutions that rose along the major faults and replaced the country rocks. Most of the igneous rocks also are closely associated with these faults.

"The quicksilver deposits comprise not only irregular and discontinuous cinnabar-bearing veins but also rock masses that contain disseminated cinnabar. All are within or very near northwest-trending fault zones, and nearly all are intimately associated with silica-carbonate rock. Most of the ore shoots are small and irregular, though a few are several hundred feet in length and height and as much as 40 feet wide. The shoots are structurally controlled by local gouge zones or by changes in dip or strike of the enclosing vein matter. The quicksilver content of the ore has a wide range, but most of the ore mined in the past has probably contained 5 to 10 pounds of quicksilver to the ton."

Only occurrences of special mineralogical interest, and some commercial occurrences outside of the three districts discussed above, will be itemized by county.

Colusa County: **1**, Cinnabar is found with free gold at the Oriental mine, a quarter of a mile west of Simmins Spring near Sulphur Creek, Mining and Scientific Press (8) p. 287. **2**, At the Manzanita mine (sec. 29, T. 14 N., R. 5 W., M. D.), sufficiently important percentages of leaf and wire gold intergrown with cinnabar, calcite, marcasite, chalcopyrite, and stibnite to warrant mining for gold have been described, Becker (4) p. 367, Goodyear (4) p. 160, Fairbanks (6) p. 120, Aubury (2) p. 44, W. W. Bradley (1) p. 189. **3**, Near Wilbur Springs, according to Hanks (19) p. 284, cinnabar was observed in actual process of deposition as crystals forming by sublimation on walls of orifices.

Contra Costa County: **1**, Indians for years knew of deposits of cinnabar on the east side of Mount Diablo that they used for paint, Mining and Scientific Press (6) p. 280. What is probably the same occurrence is described in sec. 29, T. 1 N., R. 1 E., M. D. by J. D. Whitney (7) p. 24, Irelan (3) p. 162, Aubury (2) p. 195, Becker (4) p. 378, C. P. Ross (2) p. 41. The mercury mineral in the Mount Diablo deposits is dominantly metacinnabar.

Inyo County: **1**, Cinnabar is found with metacinnabar at the Chloride Cliff mine in the Funeral Range west of Rhyolite, Nevada, Huguenin and Waring (1) p. 121. **2**, Fumaroles of the Coso Springs area

near Little Lake show interesting mineral deposition including that of cinnabar and metacinnabar, T. Warner (2) pp. 59-63, A. L. Ransome and Kellogg (1) p. 378, C. P. Ross and Yates (6) p. 395. **3**, Cinnabar from Last Chance Mountain was used for paint by the Piutes, Steward (1) p. 276.

Kern County: **1**, Cinnabar crystals disseminated in a rhyolite dike occur in the Cuddeback mine (sec. 27, T. 31 S., R. 32 E., S. B.) 3 miles from Woodford, Gillan (1) p. 79, W. W. Bradley (5) p. 47, and Tucker (4) p. 314. **2**, A similar deposit occurs 2½ miles west of Cinco, a quarter of a mile west of Los Angeles aqueduct, W. W. Bradley (5) p. 49.

Lake County: **1**, The mineral was reported adhering to nuggets of gold from Sulphur Springs in Bear Valley 10 miles northeast of Borax Lake, J. A. Phillips (1) p. 326.

Mariposa County: **1**, Crystals of cinnabar in plates and bunches are reported by Becker (4) p. 383, Turner (12) p. 678, and Lowell (1) p. 602, from the north shore of the Merced River at Horseshoe Bar, S. M. B. (12120).

Mendocino County: **1**, Cinnabar is reported with platinum, gold, iridium, and zircon from Anderson Valley placer along Navarro River, Hanks (12) p. 310.

Mono County: **1**, Beautiful crystals have come from 4 or 5 miles northeast of Bodie, 3 miles west of a volcanic cone in this region, W. W. Bradley (5) p. 72, Whiting (1) p. 356, S. M. B. (10340).

Monterey County: **1**, Cinnabar is reported as occurring in calcite southeast of Jamesburg, (SE¼ sec. 31, T. 18 S., R. 5 E., M. D.), W. W. Bradley (p.c. '46).

Napa County: **1**, Cinnabar pseudomorphous after barite crystals has been described from the Redington mine, Durand (1) p. 211. **2**, Fix and Swinney (1) pp. 31-46, report on occurrence of cinnabar in the Oakville district.

Nevada County: **1**, Cinnabar with amalgam is found in small quantities at the Odin drift mine, near Nevada City, Lindgren (20) p. 75. **2**, Other occurrences are described by W. P. Blake (10) p. 11, and Lindgren (14) p. 6.

San Bernardino County: **1**, Cinnabar occurs in quartz veins 4 to 6 feet wide 9 miles northeast of Danby, W. W. Bradley (5) p. 123, Tucker (4) p. 356. **2**, Cinnabar occurring as inclusions in bluish-gray chalcedony near the southern end of Death Valley, 15 miles northeast of Lead Pipe Springs and 30 miles northeast of Johannesburg, colors the chalcedony with reddish blotches and streaks, forming the gem stone known as "myrickite," W. W. Bradley (5) p. 123. **3**, Cinnabar occurs in the Jack mine in the Clark Mountains in thin veins of wolframite, Hess (14) p. 47, and W. W. Bradley (5) p. 123.

San Luis Obispo County: **1**, Cinnabar replaces fossil shells in the Oceanic mine (secs. 15, 21, T. 27 S., R. 9 E., M. D.), Aubury (2) p. 149, A. L. Ransome and Kellogg (1) p. 441.

San Mateo County: **1**, Cinnabar is reported with chlorides of mercury from the Corte de Madera Rancho near Searsville, west of Palo Alto, W. W. Bradley (5) p. 149.

Santa Barbara County: **1**, First California discovery of cinnabar was apparently in this county as early as 1796, Hittel (3) vol. 2, p. 549. **2**, Cinnabar is described from the Cachuma district 23 miles northeast of Solvang, Everhart (5) pp. 509-532.

Santa Clara County: **1**, Cinnabar pebbles have been recovered by panning from the gravels of Deep Gulch, close to the New Almaden mine, E. H. Bailey and Everhart (8) p. 27.

Siskiyou County: **1**, Perfect small crystals of cinnabar were found in placer gravels, Bixby (1) p. 154. **2**, Semi-transparent crystals were found in the Minnehaha mine on the Klamath River 4 miles west of Oak Bar, (sec. 22, T. 46 N., R. 10 W., M. D.), G. C. Brown (2) p. 870, Averill (3) p. 64. **3**, Cinnabar occurs at the Cowgill mine (sec. 34, T. 48 N., R. 9 W., M. D.), 12 miles from Gottville, as coarsely crystalline aggregates with metacinnabar, Hobson (1) p. 658, Aubury (2) p. 196, W. W. Bradley (5) p. 169. **4**, Small amounts of cinnabar occur in seams of hornblende schist at the Horse Creek mercury mine, (sec. 15, 16, T. 46 N., R. 10 W., M.D.), J. C. O'Brien (4) p. 460.

Sonoma County: **1**, From the Culver-Baer mine in fine crystals with native mercury and metacinnabar, Aubury (2) p. 102. **2**, Crystals from the Great Eastern mine were described by Sachs (1) p. 17, and mentioned by Aubury (2) p. 108. **3**, Cinnabar from Skaggs Springs occurs with curtisite, metacinnabar, and realgar, F. E. Wright and Allen (3) p. 169. Report on geology of the Skaggs Springs occurrences of cinnabar, was made by Everhart (4), p. 385; **4**, An additional and recent report on the Mayacmas district, was made by E. H. Bailey (6) pp. 199-230.

Stanislaus County: **1**, Cinnabar occurs in Del Puerto area, at the Adobe Valley, Summit and Winegar properties, (T. 6 S., R. 5 E., M.D.) Hawkes et al. (2) p. 79.

Trinity County: **1**, Very large crystals are said to occur at the Altoona mine, Bixby (2) p. 168. The occurrence is in sec. 22, T. 38 N., R. 6 W., M.D., Swinney (3) p. 395.

Yolo County: **1**, Crystals of cinnabar in "opalite" occur at Harrison mines (sec. 35, T. 12 N., R. 5 W., M. D.) in the Knoxville district, Aubury (2) p. 117. **2**, With petroleum and sulfur at the New England mine, ibid.

CLAUDETITE

Arsenic oxide, As_2O_3

Monoclinic. Platy crystals. One perfect cleavage. Luster pearly to vitreous. Colorless to white. H. = $2\frac{1}{2}$. G. = 3.85-4.15.

Dense white fumes and garlic odor when heated on charcoal.

Imperial County: **1**, Kelley (1) p. 137 has described the occurrence of claudetite crystals in a vein of kaolin, gypsum, halloysite, and sulphur, at a sulphur prospect 6 miles north of the 4-S Ranch and $1\frac{1}{2}$ miles west of the Colorado River. Crystals from this locality are described by Palache (8) p. 194.

Trinity County: **1**, Claudetite is reported as crusts of well-formed monoclinic crystals in the pyrrhotite deposit at Island Mountain, Landon (1) p. 279, but the occurence is probably arsenolite, Switzer (p.c. '49).

CLEAVELANDITE

See feldspar, albite

CLINOCHLORE

See chlorite group

CLINOFERROSILITE

See pyroxene

CLINOHUMITE

Basic fluosilicate of magnesium, $Mg_9(SiO_4)_4(OH,F)_2$

Monoclinic. Crystals or crystalline grains common. Luster vitreous to resinous. Color white, light yellow, honey yellow to chestnut brown. H. = 6-6.5. G. = 3.1-3.2.

Fresno County: **1**, Reported to occur in small yellowish-orange striated crystals in contact limestone of the Twin Lakes district by Chesterman (1) p. 254.

CLINOPTILOLITE

Hydrous calcium, sodium, potassium and aluminum silicate, $Ca_2Na_3Al_7Si_{33}O_{80}\cdot 23H_2O$

The validity of clinoptilolite as a species has been questioned by Hey and Bannister (1) pp. 556-559, who suggest that it is a silica-rich heulandite.

Kern County: **1**, A mineral, probably clinoptilolite, occurring as platy colorless grains, was reported by Kerr and Cameron (4) p. 234, from 5 miles east of the Tehachapi Pass at the property of the Filtrol Company.

San Luis Obispo County: **1**, Clinoptilolite was reported as a constituent of altered fragmental volcanic rocks of Miocene age in the Highland monocline, by Bramlette and Posnjak (1) p. 169.

CLINOZOISITE

Basic calcium aluminum silicate, $Ca_2Al_3(SiO_4)_3(OH)$

Monoclinic. Crystals slender prisms, usually striated. One perfect cleavage. Colorless, light yellow, green, pink. H. = 6. G. = 3.2.

Clinozoisite is a member of the epidote group, but nearly iron-free.

Inyo County: **1**, Clinozoisite is a common alteration product of igneous intrusives of the Darwin district, Kelley (4) p. 541.

Los Angeles County: **1**, Clinozoisite occurs as a network of pure-white crystals up to 1½ centimeters with interstitial chlorite and tourmaline in the Pelona schists on the north side of Sierra Pelona Valley (NE¼ sec. 12, T. 5 N., R. 14 W., S. B.), Neuerburg (p.c., '44). **2**, Quartz veins carrying clinozoisite crystals up to 3 or 4 inches and bundles of crystals up to 1 inch in diameter were abundant on the eastern edge of the old San Francisquito Canyon Reservoir, Murdoch and Webb (6) p. 354. **3**, In Pelona schist, on Bouquet Canyon highway near Bouquet Reservoir, SW¼NE¼ sec. 28, T. 6 N., R. 14 W., S.B., Durrell (p.c. '49). The mineral occurs in lenses of greenish-gray radiating prisms as much as 4 inches in size, in albite amphibolite.

Mendocino County: **1**, Clinozoisite (or epidote) in gray blades is present with lawsonite and rutile on the new Covelo road, Vonsen (p.c. '45).

Monterey County: **1**, Boulders of crystalline masses of pinkish-gray clinozoisite occur on the beach north of Willow Creek, Crippen (p.c. '51).

Riverside County: **1**, Pale brownish-green crystals up to 15 millimeters, in divergent groups, occur in pegmatite at Crestmore, Daly (1) p. 650, Woodford et al. (10) p. 370. **2**, Reported from the new city quarry, Richmond (1) p. 725.

San Bernardino County: **1**, In veins in abundant pebbles of probable Pelona schist, just east of the summit of Cajon Pass in canyons north of the main highway, Murdoch and Webb (p.c., '43).

Sonoma County: **1**, Specimens of clinozoisite associated with glaucophane S. M. B. (21318), came from 2½ miles east of Valley Ford.

COBALT BLOOM

See erythrite

COBALTITE

Sulpharsenide of cobalt, (Co,Fe)AsS

Isometric. Commonly in cubes and pyritohedrons; also massive. Cleavage perfect cubic. Metallic luster. Color tin white. Streak grayish black. H. = 5½. G. = 6-6.3.

On charcoal it gives sulphur odor and white coating of arsenic oxide when roasted. The residue becomes magnetic. Borax bead of the roasted material is cobalt blue. Ammonia colors a nitric acid solution of cobaltite pink.

Madera County: **1**, Cobaltite is reported to have formed more than 1½ percent of one lot of ore from the 200-foot level of the Jessie Bell mine, SE¼ sec. 13, T. 9 S., R. 18 E., M. D., Logan (24) p. 452.

Mariposa County: **1**, Good cobaltite crystals were found in the Copper Chieftain mine S. M. B. (15481).

Mono County: **1**, It occurred with gold in the Tioga mine, Turner (3) p. 469.

Nevada County: **1**, Small seams of cobaltite with chalcopyrite occur in a schist on Rattlesnake Creek south of Signal Peak (T. 17 N., R. 13 E., M. D.), Lindgren (19) p. 7, E. M. Boyle (1) p. 37. **2**, Cobaltite was reported from the Otis ledge, Meadow Lake (T. 18 N., R. 13 E., M. D.), C. W. Raymond (1) p. 48.

Placer County: **1**, It was found with arsenopyrite in the Metallic mine, near Cisco, S. M. B. (1901). **2**, With chalcopyrite about 4 miles northeast of Alta, S. M. B. (13493).

COCCINITE

Iodide of mercury, HgI_2

Isometric. Color scarlet.

Kern County: **1**, Reported from San Emigdio Canyon (probably in the antimony mines?), Hanks (12) p. 147, (15) p. 104.

Santa Barbara County: **1**, Reported by G. E. Moore, in Cronise (1) p. 593.

*COLEMANITE (1883)

Hydrous calcium borate, $Ca_2B_6O_{11}\cdot 5H_2O$

Monoclinic. Crystals usually short prismatic. Massive, granular and compact. One perfect cleavage. Vitreous to adamantine luster. Colorless, white, yellowish white, gray. H. = 4-4½. G. = 2.42.

Decrepitates violently when touched with hot flame, but finally fuses to a clear glass. Powder on platinum wire, moistened with sulphuric acid, will give a momentary green flame of boron mixed with reddish flame of calcium. Yields water in a closed tube. Soluble in hot hydrochloric acid with separation of boric acid on cooling.

Colemanite was first discovered in Death Valley in October 1882 by R. Neuschwander, Hanks (11) p. 86 (with analysis by Price) and later (April 1883) in the Calico district, A. W. Jackson (3) p. 358. Subse-

quently the deposits were described by many writers. A discussion of the origin of colemanite is found in H. S. Gale (3) p. 3.

Analysis

B_2O_3	CaO	H_2O
48.12	28.43	22.20

Inyo County: **1**, Colemanite was discovered in the Death Valley region, where immense deposits of it occur along Furnace Creek in the Amargosa Range, A. W. Jackson (3) p. 358, G. E. Bailey (2) p. 46, M. R. Campbell (1) p. 16, Engineering and Mining Journal (10) p. 781, Foshag (10) p. 8. **2**, Occurs near Ryan, G. E. Bailey (2) p. 48, H. S. Gale (2) pp. 861-865; Cloudman et al. (1) p. 863, Foshag (10) p. 9. Analyses of material from both occurrences are presented by Whitfield (1) pp. 281-287. **3**, Some colemanite crystals from the Biddy McCarthy mine were shown by A. F. Rogers (20) p. 135 to be pseudomorphs after inyoite. The crystals were formed by dehydration of inyoite. **4**, Important deposits of colemanite with ulexite occur in clay-shale near Shoshone (T. 22 N., R. 7 E., S. B.) Noble (3) p. 63. **5**, Colemanite has been reported from Bennetts Wells on the floor of Death Valley, as surface incrustations, G. E. Bailey (2) p. 45, but the samples were probably inaccurately identified.

Kern County: **1**, Colemanite occurs with kernite and borax in the Kramer district, (sec. 22, T. 11 N., R. 8 W., S. B.) Yale and Gale (4) p. 287, Noble (2) p. 47, Schaller (41) p. 24, (45) p. 138.

Los Angeles County: **1**, An important and extensive deposit of colemanite which Eakle (10) p. 179 (with analysis) described as a variety, and called "neocolemanite," occurs at the Sterling borax mine near Lang. Hutchinson (1) p. 16 shows it to be identical with colemanite. It occurs as thin and thick seams, and has considerable howlite associated with it (see also F. J. H. Merrill (2) p. 480, and Armstrong and Van Amringe (1)).

Riverside County: **1**, Colemanite reportedly occurs in the foothills of the San Bernardino Range northeast of Salton Sea (N. R.).

San Bernardino County: **1**, The extensive deposit of colemanite at Borate, in the Calico district near Yermo was discovered in the spring of 1883 and became the principal source of borax before the Death Valley colemanite deposits were worked. Beautiful crystals of colemanite in large geodal masses occur with celestite crystals. The colemanite is described by A. W. Jackson (1) p. 447, (2) p. 3, (3) p. 358, G. E. Bailey (2) p. 56, Eakle (2) p. 31, Foshag (9) p. 208. Analyses by Hiortdahl (1) p. 25, Bodewig and Rath (1) p. 290. **2**, Reported from 4 miles west of Lone Willow Springs in the south flank of Browns Mountain, G. E. Bailey (2) p. 12. **3**, From Lone Star Range (T. 18 N., R. 2 E., S. B.), in beds 2 to 3 feet thick, G. E. Bailey (2) p. 62, Cloudman et al. (1) p. 855. **4**, Cavities lined with slender colemanite crystals on calcite crystal crusts are found in old borax mines on the north side of Lead Mountain, northeast of Barstow, Durrell (p.c. '46). **5**, Reported from Searles Lake, De Groot (2) p. 537 [probably an error]. **6**, Collected as float in the lower canyon of the Amargosa River, G. E. Bailey (2) p. 62, and Cloudman et al. (1) p. 855. **7**, Reported from Owl Holes (T. 18 N., R. 3 E., S. B.) in niter beds with priceite (?), G. E. Bailey (2) p. 62, Cloudman et al. (1) p. 855. **8**, Also from Pilot beds at south

end of Slate Range southeast of Searles Lake under niter beds, G. E. Bailey (2) p. 63, Cloudman et al. (1) p. 856. **9**, From southeast of Cave Springs on the south flank of the Avawatz Mountains on the road from Daggett, G. E. Bailey (2) p. 60, Cloudman et al. (1) p. 854. (Bailey notes this occurrence as "borate of lime," with sodium carbonates and sulphates, and it is probably ulexite.)

Ventura County: **1**, Deposits of colemanite, similar to those at Lang, in Los Angeles County, occur on Frazier Mountain, G. E. Bailey (2) p. 70, H. S. Gale (3) p. 5, (11) p. 440.

Additional references to literature on colemanite: Arzruni (1) p. 272, J. T. Evans (1) p. 57, (2) p. 37, Mülheims (1) p. 202, Baumhauer (1) p. 107, M. R. Campbell (1) p. 517, (2) p. 401, Foshag (7) p. 199.

An excellent general summary of the origin of borate deposits is found in Foshag (13) p. 419. A collecting expedition of interest to amateurs is described by Foshag (15) p. 39.

COLLOPHANE

See apatite

COLORADOITE

Mercuric telluride, HgTe

Isometric. Massive, granular. Octahedral cleavage. Metallic luster. Color iron black. H. = 2½. G. = 8.07.

Gives white coating of telluric oxide and globules of mercury when roasted on charcoal. Gives the characteristic reaction for tellurium like tetradymite.

Calaveras County: **1**, Reported from the Stanislaus mine on Carson Hill, A. Knopf (11) p. 39.

Tuolumne County: **1**, Hillebrand (3) p. 62, found one specimen which he identified as coloradoite, associated with the other tellurides of the Norwegian mine near Tuttletown; see also W. W. Bradley (5) p. 203.

COLUMBITE—Tantalite

Niobate and tantalate of iron and manganese, $(Fe,Mn)(Nb,Ta)_2O_6$

Orthorhombic. Prismatic crystals, massive. Cleavage, one good. Brittle. Submetallic luster. Color iron black, brownish black. Streak dark red to black. H. = 6. G. = 5.3-7.3.

Fused with potassium bisulphate, then dissolved in hydrochloric acid, the solution boiled down with tin assumes a deep-blue color. Gives the green color of manganese when fused with sodium carbonate. Insoluble.

Columbite is the niobium-rich member and *tantalite* the tantalum-rich member of a series in which these two elements are completely interchangeable.

Calaveras County: **1**, Tantalite has been reported near Milton, Irelan (4) p. 47.

Los Angeles County: **1**, Small crystals of columbite have been found in a small pegmatite at the head of Rattlesnake Canyon SW¼ sec. 36, T. 4 N., R. 14 W., S.B., Gregory (p.c. '51).

Madera County: **1**, Massive and crystalline black columbite (tantalum-rich?) has been found at the Reynolds mine, Kings Creek district, Irelan (4) p. 46, S.M.B. (13546).

Riverside County: **1**, Columbite (30 percent tantalum-rich) rich in manganese and poor in iron, is found at the Fano mine, in fan-shaped masses of radiating crystals up to 3 inches, in an albite-quartz mixture

in pegmatite, Fisher (1) p. 75. **2**, Minute platy crystals of probable columbite occur in cleavelandite (sec. 16, T. 7 S., R. 2 E., S. B.) about 400 yards west-southwest of the northeast corner, Fisher (1) p. 67. **3**, From the Anita mine 10 miles southeast of Hemet (west-southwest of center sec. 22, T. 6 S., R. 12 E., S. B.) as minute wafers with garnet, lepidolite, and albite, ibid. p. 85.

San Diego County: **1**, A crystal of columbite from the Little Three mine, near Ramona was described by Eakle (7) p. 87, Schrader et al. (1) p. 53. **2**, Small imperfect crystals were found at the Victor mine, Rincon, A. F. Rogers (4) p. 217. **3**, Occurs in the Clark vein at Rincon up to 2 inches, in well-formed crystals, Murdoch (p.c., '45), Hanley (1) p. 17. **4**, It is also reported from the Mack mine, Rincon (sec. 25, T. 10 S., R. 1 W., S. B.) Kunz (24) p. 50. **5**, From Pala, Kunz (23) p. 942. **6**, From the Mountain Lily mine on Aguanga Mountain in pegmatite, Kunz (24) p. 62. **7**, It occurs in good crystals associated with cassiterite, tourmaline, albite, and orthoclase in the Chihuahua Valley, 10 miles east of Oakgrove (SW¼ sec. 12, T. 9 S., R. 3 E., S. B.), Schaller (36) p. 353. **8**, Columbite, rich in tantalum and manganese, from the Catharina mine, near Pala was analyzed by Schaller, Clarke (10) p. 345.

COOKEITE

Hydrous lithium and aluminum silicate, $(Li,Al)_4(Si,Al)_4O_{10}(OH)_4 \cdot 2H_2O$

Monoclinic. In pseudo-hexagonal plates; rounded aggregates. Micaceous cleavage. Color white, yellowish, pale pink, deep pink. H. = 2½. G. = 2.67.
Fuses and exfoliates before the blowpipe.

San Bernardino County: **1**, Cookeite has been reported from Oro Grande, S.M.B. (12826).

San Diego County: **1**, Cookeite from Pala has been reported by Kunz (23) p. 942, and analyzed by Schaller, Clarke (9) p. 288. **2**, Colorless and deep-pink cookeite is found in pockets at the Victor mine, Rincon, coating quartz, lepidolite, orthoclase, albite, and kunzite, and as pseudomorphs after kunzite, A. F. Rogers (4), p. 216.

COPIAPITE

A basic ferric sulphate, perhaps $Fe_4(OH)_2(SO_4)_5 \cdot 18H_2O$

Orthorhombic. Crystalline scales, or granular massive; incrustations. Cleavage basal perfect. Pearly luster. Color sulphur yellow. H. = 2½. G. = 2.10.
Similar to coquimbite in its reactions.

Alameda County: **1**, Copiapite was found as yellow needles at the Alma mine, Leona Heights, Larsen (11) p. 61; analysis by Schaller (1) p. 214.

Contra Costa County: **1**, Reported from Mount Diablo mine (SE¼ sec. 29, T. 1 N., R. 1 E., M. D.), C. P. Ross (2) p. 42.

Lake County: **1**, It occurred at Sulphur Bank, Becker (4) p. 389; analysis by Melville and Lindgren (1) p. 25; Everhart (1) p. 139.

Napa County: **1**, Knoxvillite, described as a new mineral from the old Redington mine, has been identified as magnesio-copiapite, which see.

Riverside County: **1**, Specimens of copiapite as yellowish-brown crystalline masses, with amarantite have been described from the Santa Maria Mountains by Schairer and Lawson (1) p. 242, with analysis. Probably identical with a locality mentioned as "near Blythe" by

Larsen (11) p. 61. Magnesian copiapite has been analyzed from the Santa Maria Mountains near Blythe, Bandy (2) p. 737. It is reported as associated with amarantite, Dana (VII 2), p. 626.

San Bernardino County: **1**, Copiapite occurs as pale-yellow scaly masses with krausite, coquimbite, and alunite in the Calico Hills near Borate, about 6 miles northeast of Yermo, Foshag (19) p. 352.

Trinity County: **1**, Copiapite occurs with pyrrhotite as pale-brown scaly masses at the Island Mountain copper mine, Vonsen (p.c., '45), analysis by Foshag (p.c., '29).

COPPER

Native copper, Cu

Isometric. Good crystals rare. Generally in wires, thin sheets and arborescent crystal clusters. No cleavage. Malleable and ductile. Luster metallic. Color copper-red. Streak metallic, shining. H. = $2\frac{1}{2}$-3. G. = 8.8-8.9.

B.B. fuses readily. Soluble in nitric acid. The solution turns deep azure blue with excess of ammonia.

Metallic copper has been found in most of the copper mines of the state, but no commercial deposits of native copper are known. It is frequently mixed with cuprite and malachite in the oxidized zone of copper deposits, or found as coatings along the walls of copper veins, or near intrusive dikes, which have brought about a natural reduction of the ores. Most occurrences of chalcopyrite have yielded some native copper.

Alameda County: **1**, Fine arborescent groups of native copper crystals were found in the Alma pyrite mine at Leona Heights, East Oakland. The minerals of this mine have been described by Schaller (1) p. 195.

Amador County: **1**. Arborescent masses of copper occurred in the old Newton mine, Woodhouse (p.c., '45).

Calaveras County: Some of the mines along the copper-sulphide belt, especially **1**, at Copperopolis, Irelan (3) p. 151, J. D. Whitney (7) p. 255, and **2**, at Campo Seco, Hanks (12) p. 152, S.M.B. (6049) have produced native copper. Other localities are mentioned: Aubury (1) p. 190; Hanks (12) p. 152, S.M.B. (1751).

Colusa County: **1**, It is found in serpentine with cuprite and tenorite at the Gray Eagle mine (sec. 20, T. 16 N., R. 6 W., M. D.), Aubury (4) p. 159. **2**, Also at the Candace, S.M.B. (2439), and Lion mine (sec. 17, T. 17 N., R. 6 W., M. D.), with cuprite. First discovered here in 1863, J. H. Rogers (1) p. 320, W. W. Bradley (1) p. 178.

Del Norte County: **1**, Some large pieces of native copper have come from the Diamond Creek district, Aubury (1) p. 115. **2**, From the Keystone mine in the Rockland district in masses up to 300 pounds, J. D. Whitney (7) p. 362, Aubury (1) p. 115. **3**, From near Crescent City, in serpentine (?), Richthofen (3) p. 44.

El Dorado County: Native copper occurs in numerous places in this county, wherever significant copper deposits are known. Some localities are mentioned by Hanks (12) p. 152; Tucker (3) pp. 276-278; Aubury (1) p. 177.

Glenn County: Large float pieces of native copper have been found **1**, a few miles north of Chrome Mountain (N.R.), and **2**, on Elk Creek (N.R.). **3**, Near Peckville (sec. 18, T. 18 N., R. 6 W., M. D.), Aubury (1) p. 132.

Humboldt County: **1**, It occurs on Red Cap and Boise creeks as float, Crawford (1) p. 66, Aubury (1) p. 127, W. P. Blake (14) p. 124. **2**, Reported from Horse Mountain in masses up to 400 pounds as float (T. 6 N., R. 4 E., H.), Aubury (4) p. 153, Laizure (3) p. 305.

Imperial County: **1**, Reported from the Cargo Muchacho district, Henshaw (1) p. 185.

Inyo County: **1**, The copper deposits in the Ubehebe Mountains contain native copper, Aubury (1) p. 245. **2**, Copper comes from Chloride Cliff, Death Valley, Ball (1) p. 73, (2) p. 174.

Lake County: **1**, It was reported from the head of Little Indian Valley, as large pieces in rich oxide ores, Aubury (1) p. 138.

Lassen County: **1**, Native copper occurred in epidote rock at the Lummis mine, Woodhouse (p.c., '45). **2**, In the Meadow Mountains district (sec. 28, T. 28 N., R. 10 E., M. D.), 9 miles southeast of Westwood, Laizure (1) p. 508.

Los Angeles County: **1**, It was found in quartz at the Free Cuba mine, near Acton, F. J. H. Merrill (2) p. 471.

Madera County: **1**, Reported from north of the June Belle mine near Daulton (T. 9 S., R. 18 E., M. D.) in quartz veins, Forstner (4) p. 747.

Mariposa County: **1**, Massive copper occurred with malachite in the Copper Queen mine (sec. 19, T. 5 S., R. 19 E., M. D.) Aubury (1) p. 216. **2**, Reported from north fork of Chowchilla Creek (sec. 34, T. 6 S., R. 19 E., M. D.), Aubury (1) p. 216. **3**, From Satellite mine, with melaconite, S. M. B. (12010).

Mendocino County: **1**, Sheets and grains of metallic copper occur at Red Mountain, 15 miles southeast of Ukiah (sec. 23, T. 15 N., R. 11 W., M. D.), Aubury (4) p. 161. **2**, In the serpentines in Lost Valley, Crawford (1) p. 67.

Merced County: **1**, Copper occurs with quartz and chalcopyrite in the Victor Bonanza mines, 16 miles from Dos Palos (T. 13 S., R. 9 E., M. D.), Lowell (1) p. 605.

Modoc County: **1**, It was observed with malachite and limonite at the Seitz mine 7 miles south of Fort Bidwell, Tucker (3) p. 241.

Mono County: **1**, It was found sparingly in the Detroit mine, Jordan district, 6 miles northeast of Lundy, S. M. B. (7378).

Napa County: **1**, Found near St. Helena with cuprite, Hanks (12) p. 158. **2**, 6 miles west of Monticello, W. W. Bradley (28) p. 207, S. M. B. (20908).

Nevada County: **1**, It occurs with gold in quartz at Meadow Lake, John A. Veatch (2) p. 210. **2**, With chalcocite and graphite at Buckeye Hill, Sweetlands, Mining and Scientific Press (2) p. 5, (3) p. 5. **3**, From South Yuba mine, Engineering and Mining Journal (14) p. 230.

Placer County: **1**, It occurred at the Algol mine near Spenceville (sec. 9, T. 13 N., R. 7 E., M. D.) Aubury (1) p. 173. **2**, At Valley View mine 6 miles from Lincoln (sec. 24, T. 13 N., R. 6 E., M. D.), Silliman (7) p. 351, C. A. Waring (4) p. 329. **3**, Lindgren (7) p. 272 reported native copper as one of the minerals of the Ophir district, from the Gold Blossom shaft.

Plumas County: **1**, It occurs with rhodonite at Mumfords Hill, Hanks (12) p. 152. **2**, Large lumps of copper occurred with cuprite, malachite, and native silver in the old Pocohontas mine, Indian Valley,

20 miles from Susanville, Crawford (1) p. 69. **3**, Blackened grains and scales of copper were found in placers from North Fork of the Feather River, Edman (1) p. 372.

Riverside County: **1**, It occurs in the McCoy Mountain district, 20 miles southwest of Blythe, F. J. H. Merrill (2) p. 525.

San Luis Obispo County: **1**, Reported from the Tip Top mine 3 miles southwest of Santa Margarita, Aubury (1) p. 147. **2**, From Refugio claim on Chorro Creek, 7 miles north of San Luis Obispo, ibid. p. 148. **3**, Copper occurs as fine wires in serpentine southwest of Santa Margarita near summit of Santa Lucia Range, Logan (3) p. 686, Laizure (3) p. 512. **4**, With barite in the manganese property of the Noble Electric Company, Taliaferro and Hudson (3) p. 269.

Santa Barbara County: **1**, Hanks (12) p. 152 quotes Blake as recording copper in serpentine from the county.

Shasta County: Aborescent growths and compact masses of copper have been found in many of the copper mines of the county. Specimens have come from the Bully Hill and Copper City mines, Shasta King mine, Mountain Copper and Mammoth mines, Balaklala, Greenhorn, Kosk Creek, and other mines. Some localities are described in: Aubury (1) p. 65, Turner (26) p. 276, Hamilton and Root (5) pp. 91-93, Tucker (9) p. 433, L. L. Root (4) p. 149.

Sierra County: **1**, Reported from Bassetts' Pride mine (sec. 11, T. 20 N., R. 12 E., M. D.) 5 miles northeast of Sierra City, E. M. Boyle (3) p. 30.

Siskiyou County: **1**, Copper is found in slate from Humbug Creek north of Yreka, S. M. B. (10600).

Tehama County: **1**, Small amounts of native copper occurred at Basler (sec. 4, T. 25 N., R. 7 W., M.D.), J. C. O'Brien (3) p. 189.

Trinity County: Occurs **1**, with hausmannite, barite, and copper carbonates in the Blue Jay mine (NW¼, sec. 17, T. 26 N., R. 12 W., M. D.) J. C. O'Brien (1) p. 84, Taliaferro and Hudson (3) p. 269; **2**, in crystals and masses from North Fork Trinity River (secs. 27, 28, 34, T. 34 N., R. 11 W., M. D.), J. B. Trask, (1) p. 24.

Tulare County: **1**, Masses of copper have been found on the Middle Fork of Tule River, about 30 miles east of Porterville (sec. 30, T. 19 S., R. 31 E., M. D.) Aubury (1) p. 234.

COPPERAS

See melanterite

COPPER GLANCE

See chalcocite

COPPER PYRITES

See chalcopyrite

COQUIMBITE

Hydrous iron sulphate, $Fe_2(SO_4)_3 \cdot 9H_2O$

Hexagonal-rhombohedral. Generally granular, massive. Vitreous luster. Color white, yellowish, brownish, greenish, violet. H = 2-2½. G = 2.09.

Fusible. Becomes magnetic on heating. Gives water in closed tube. Soluble in water and has an astringent taste.

Calaveras County: **1**, Coquimbite was found at Quail Hill, Silliman (7) p. 351.

El Dorado County: **1**, It occurred in siliceous shales near Georgetown, S. M. B. (11249).

Inyo County: **1**, Yellow crystals of coquimbite have been found near Lone Pine, S. M. B. (7667).

Napa County: **1**, Large masses of yellowish-green, granular coquimbite found at the old Redington cinnabar mine were described by Eakle [analysis by Schaller] (1) p. 322.

Placer County: **1**, Reported from Valley View mine (Whiskey Hill) 6 miles north of Lincoln, with chalcanthite, Silliman (7) p. 351, J. R. Browne (4) p. 111, Logan (17) p. 40. (Wrongly listed under Tuolumne County in older editions of this bulletin.)

San Bernardino County: **1**, Coquimbite occurs with krausite and alunite near Borate in the Calico Hills about 6 miles northeast of Yermo, Foshag (19) p. 352.

CORDIERITE—Iolite

Magnesium, iron aluminum silicate, $(Fe,Mg,Mn)_2(Al,Fe)_4Si_5O_{18} \cdot H_2O$

Orthorhombic. Prismatic. Embedded grains, massive. Cleavage, one direction, distinct. Brittle. Vitreous luster. Color blue to whitish gray. H. = 7-7½. G. = 2.60-2.66.

Fuses with difficulty. Partially decomposed by acid.

Cordierite occurs chiefly as a microscopic constituent of highly aluminous metamorphic rocks.

Lake County: **1**, Purple cordierite occurs in a "gem stone" prospect in the SE¼ SE¼ sec. 20, T. 12 N., R. 7 W. The material was originally described as amethystine quartz, Brice (1), p. 62.

Los Angeles County: **1**, Cordierite is a common constituent of the "spotted slates" of the Santa Monica Mountains, in megascopic subhedral crystals, Hoots (1) p. 88.

Mariposa County: **1**, It is reported from the Green Mountain district with anthophyllite, W. W. Bradley (29) p. 311.

Riverside County: **1**, Found in small grains in pegmatite with andalusite near Winchester, Murdoch (3), p. 69, Heinrich (1), p. 178.

Tulare County: **1**, Cordierite occurs with andalusite, biotite, quartz and orthoclase in a metamorphic rock on the north side of the South Fork of Kaweah River about two-thirds of a mile southeast of Three Rivers, between secs. 25 and 36, T. 17 S., R. 28 E., M. D., Durrell (p.c., '45).

CORONADITE

Oxide of lead and manganese, $MnPbMn_6O_{14}$

Tetragonal or pseudo-tetragonal. Massive: in botryoidal crusts, fibrous. Luster, dull to submetallic. Color, dark gray to black. Streak brownish black. H. = 4½-5. G. = 5.44.

Inyo County: **1**, Reported by Charles Milton (p.c., '45) in massive form from an unknown locality. **2**, From the Modoc mining district, Fleischer and Richmond (1) p. 283.

CORUNDOPHYLLITE

See chlorite

CORUNDUM

Aluminum oxide, Al_2O_3

Hexagonal-rhombohedral. Prismatic crystals and massive. Brittle; when compact very tough. Adamantine to vitreous luster. Color generally bluish gray; also blue, red, yellow, brown, gray. Streak uncolored. H. = 9. G. = 3.95-4.10.

Infusible and insoluble. Fragments moistened with cobalt nitrate and intensely heated assume a sky-blue color.

Corundum-bearing rocks are rare in the state and no workable deposits of this useful mineral are known. The gem varieties, ruby and sapphire, have not been found in good clear crystals.

Butte County: **1**, A few sapphires are said to have been found with diamonds in stream gravels in this county (N. R.).

Los Angeles County: **1**, The first mention of corundum in the state was of some sapphire-blue pebbles found in San Francisquito Pass, W. P. Blake (9) p. 10, Hanks (12) p. 157, Kunz (24) p. 45. **2**, From Santa Catalina Island in gneiss with kyanite, E. H. Bailey (1) p. 1955.

Mono County: **1**, Coarse nodular masses of corundum occur with the andalusite at the mine of Champion Sillimanite, Incorporated, on the western slope of the White Mountains, 7 miles east of Mocalno, Peck (1) p. 151, Kerr (3) p. 633.

Plumas County: **1**, Large violet-blue crystals occur in the plumasite of Spanish Peak, Lawson (5) p. 219, Kunz (14) p. 436, (24) p. 45.

Riverside County: **1**, Large crystals of corundum have been found near the summit of the San Jacinto Mountains (sec. 5, T. 4 S., R. 1 E., S. B.) Murdoch and Webb (14) p. 328. **2**, Blue crystals up to half an inch in length were collected from a pegmatite near Winchester (sec. 12, T. 5 S., R. 2 W., S. B.) with andalusite, Webb (11) p. 581.

San Bernardino County: **1**, Corundum was found in the Kingston Range, Kunz (24) p. 45. **2**, Pale-rose to deep-lilac crystals of corundum occur in metamorphosed limestone in Cascade Canyon, a branch of San Antonio Canyon, in the San Gabriel Mountains, Louderback and Blasdale (6) p. 793, Merriam and Laudermilk (1) p. 716. **3**, Found at head of Cascade Canyon as $\frac{1}{8}$- to $\frac{1}{2}$-inch blue crystals disseminated in rock near lapis lazuli occurrence, Schmeltz (1) p. 69.

San Diego County: **1**, It is a microscopic constituent of the dumortierite schist of Dehesa, Schaller (7) p. 97. **2**, Pink and gray crystals of corundum occur in a vein with garnet in mica schist on the northern slope of the San Miguel Mountains, 26 miles east of San Diego, Kunz (24) p. 45. **3**, Blue corundum is reported from Tule Mountain, north of Jacumba (N. R.).

Sierra County: **1**, Emery is reported sparsely in aggregates in sec. 1, T. 19 N., R. 8 E., M. D., Crawford (1) p. 406.

COVELLITE

Cupric sulphide, CuS

Hexagonal. Commonly massive. Cleavage one direction. Submetallic to resinous luster. Color indigo blue. Streak grayish black. H. = $1\frac{1}{2}$-2. G. = 4.6.

Gives a stronger odor of sulphur than is obtained from chalcocite, otherwise the reactions are the same. Distinguished by color.

Covellite is much rarer than chalcocite. It is usually associated with bornite, chalcocite, or chalcopyrite.

Calaveras County: **1**, Covellite has been found at the Satellite mine near Campo Seco, S. M. B. (14351). **2**, A. F. Rogers (6) p. 300 mentions specimens of covellite from the Poole mine at Nassua and from a prospect between Nassua and Copperopolis in which covellite formed by replacement of sphalerite.

Imperial County: **1**, Found in the Cargo Muchacho district, Henshaw (1) p. 185.

Inyo County: **1**, Covellite occurs as veinlets in sphalerite and blebs in galena in the mines of the Panamint district, Murphy (2) p. 323.

Mono County: **1**, Small amounts of covellite have been found in Blind Spring Hill, A. L. Ransome (2) p. 172.

Nevada County: **1**, Occurs with gold and chalcopyrite, from Spenceville, S. M. B. (13866).

Plumas County: **1**, It occurs in blue needles as a marginal replacement of bornite and chalcopyrite at Engels, Turner and Rogers (32) p. 379.

Shasta County: **1**, Covellite occurs in the Balaklala mine, G. C. Brown (2) p. 762, Tucker (9) p. 427. **2**, At the Bully Hill mine as an alteration of chalcopyrite, A. F. Rogers (6) p. 302. **3**, Covellite is found as a coating on pyrite at the Mountain Monarch prospect 2 miles south of Whiskeytown, Ferguson (1) p. 44.

Sierra County: **1**, It was found at the Black Jack mine, Kanaka Creek (N.R.).

Siskiyou County: **1**, Small amounts of covellite occur with some bornite and chalcopyrite at the Preston Peak mine (sec. 22, T. 17 N., R. 5 E., H.) J. C. O'Brien (4) p. 428.

Tuolumne County: **1**, Near Groveland, W. W. Bradley (26) p. 608.

CREDNERITE

Oxide of copper and manganese, $CuMn_2O_4$

Monoclinic? Foliated masses. Cleavage perfect one direction. Metallic luster. Color iron black to steel gray. Streak brownish black. H. = 4½. G. = 4.95-5.1.

Gives the manganese reactions like hausmannite, and in addition, a blue copper chloride flame when dipped in hydrochloric acid and heated in bunsen flame.

Napa County: **1**, Massive crednerite occurs near Calistoga, S.M.B. (15349).

CREEDITE

Hydrous basic calcium aluminum sulfate with fluorine, $Ca_3Al_2F_4(OH,F)_6SO_4 \cdot 2H_2O$

Monoclinic. In grains, prismatic crystals and radiating masses. Usually colorless, rarely purple. H. = 4. G. = 2.7. One perfect cleavage.

Inyo County: **1**, Well-crystallized creedite has come from the Anaconda mine at Darwin, (Noren p.c., '54).

† CRESTMOREITE, 1917

See riversideite and tobermorite

CRISTOBALITE

Silicon dioxide, SiO_2

Isometric. Small octahedrons. Dull luster. Color white. H. = 6-7. G. = 2.27.

Infusible and insoluble like quartz.

Imperial County: **1**, Cristobalite occurs with tridymite and feldspar in an obsidian metamorphosed by hot gases on Cormorant Island, Salton Sea, A. F. Rogers (30) p. 219, (42) p. 328.

Inyo County: **1**, Cristobalite is associated with orthoclase, tridymite, opal, fayalite, and magnetite in the linings of small spherical cavities in obsidian near Little Lake, about 8 miles west of Coso Hot Springs, A. F. Rogers (23) p. 213, W. W. Bradley (28) p. 494, S. M. B. (20946).

Modoc County: **1**, Occurs on summit of Mount Hoffman in botryoidal masses lining cavities in dacite, Powers (1) p. 272.

Mono County: **1**, Occurs in spherulites with feldspar from Casa del Diablo, A. F. Rogers (30) p. 82.

Nevada County: **1**, A specimen from Donner Lake is found in the Stanford University collection.

Plumas County: **1**, Occurs with anauxite in cavities in pyroxene andesite, sometimes as paramorphs after tridymite at Drakesbad, A. F. Rogers (38) p. 160. **2**, In scattered minute crystals on fracture surfaces of basalt near Two Rivers, Murdoch (15) p. 500.

Riverside County: **1**, Cristobalite has been identified accompanying lechateliérite, in fulgarites near Indio, A. F. Rogers (50) p. 120.

Shasta County: **1**, From Black Butte, near Mount Shasta, specimen in Stanford University collection.

Siskiyou County: **1**, Cristobalite occurs with fayalite in lithophysae in spherulitic obsidian, near Canyon Butte (sec. 13, T. 44 N., R. 43 E., M. D.), C. A. Anderson (p.c., '45). **2**, Reported from Shasta Springs, in Stanford University collection.

Tehama County: **1**, Cristobalite is a constituent of volcanic rock near Tuscan Springs, A. F. Rogers (18) p. 222.

Tuolumne County: **1**, Distinct octahedral crystals of cristobalite occur in augite andesite, near Jamestown, A. F. Rogers (18) p. 224, (30) p. 85, (38) p. 160.

CROCIDOLITE

See amphibole, soda amphibole

CROCOITE

Lead chromate, $PbCrO_4$

Monoclinic. Long prismatic crystals; granular. Cleavage prismatic, rather distinct. Sectile. Adamantine to vitreous luster. Color bright red. Streak orange yellow. H. = 2½-3. G. = 5.9-6.1.

Fusible. In the closed tube decrepitates and blackens, but recovers its original color on cooling. With salt of phosphorus gives an emerald-green bead.

Inyo County: **1**, Crocoite was reported in the Darwin mines with wulfenite (N. R.).

Riverside County: **1**, It is reported as occurring with wulfenite in El Dorado mine, near Indio (N. R.).

CROSSITE

See amphibole, soda amphibole

CUBANITE

Copper-iron sulphide, $CuFe_2S_3$

Orthorhombic. Generally massive. Metallic luster. Color bronze yellow. Streak black. H. = 3½. G. = 4.7.

Gives reactions similar to chalcopyrite.

Madera County: **1**, Occurs in the Daulton mine, 1 mile southeast of Daulton station, W. W. Bradley (32) p. 106.

Plumas County: **1**, Cubanite occurs with chalcopyrite and pyrrhotite in the Walker mine, 9 miles northeast of Spring Garden, A. Knopf (14) p. 244.

San Luis Obispo County: **1**, A large mass of cubanite (1,000 pounds) is said to have been found on Santa Rosa Creek, near San Simeon. Hanks (12) p. 158, considers this doubtful.

CULSAGEEITE

See vermiculite

CUMMINGTONITE

See amphibole

CUPRITE—Red Copper Ore

Cuprous oxide, Cu_2O

Isometric. Small cubes and octahedrons. Generally massive. Brittle. Adamantine to submetallic luster. Color red. Streak brownish red. H. = 3½. G. = 5.85-6.15.

Mixed with sodium carbonate, it is easily reduced on charcoal to metallic copper. Soluble in concentrated hydrochloric acid, and when cooled and diluted with cold water, yields a heavy white precipitate of cuprous chloride.

Chalcotrichite is a delicate hair-like variety of cuprite.

Cuprite is an important ore of copper. It occurs in most of the copper localities as a secondary mineral in the oxidized portions of the deposits. Massive specimens have come from various counties, but no large bodies of cuprite are known in California. Only occurrences of mineralogical interest will be given specific references.

Calaveras County: **1**, Masses of cuprite as very rich ore with chalcopyrite are occasionally found at Copperopolis, J. D. Whitney (7) p. 255, Reid (3) p. 398.

Colusa County: **1**, Chalcotrichite was found with massive cuprite in the Lion mine (sec. 17, T. 17 N., R. 6 W., M. D.), S.M.B. (13484), J. R. Browne (4) p. 210, W. W. Bradley (1) p. 178.

Del Norte County: **1**, Deposits in veins up to 4 feet wide are found in the Rockland district, McGregor (1) p. 167.

Riverside County: **1**, Abundant masses occur in the Red Cloud mine, Pacific mining district, Chuckawalla Mountains, Orcutt (2) p. 901.

References to other localities by county are: *Calaveras,* Silliman (7) p. 349; *Colusa,* Hanks (12) p. 158, (15) p. 104; *Del Norte,* Hanks (12) p. 158; (15) p. 105, Aubury (1) p. 115; *El Dorado,* Aubury (1) p. 181, (4) p. 212, Tucker and Waring (2) p. 276; *Fresno,* Irelan (3) p. 209; *Humboldt,* W. P. Blake (14) p. 124, Laizure (3) p. 306; *Imperial,* Henshaw (1) p. 185; *Inyo,* Aubury (1) p. 245, (4) p. 301, Zalinski (1) p. 81, C. A. Waring and Huguenin (2) pp. 69, 70; *Kern,* Hanks (12) p. 158, Storms (13) p. 635; *Mariposa,* W. P. Blake (9) p. 20, Hanks (12) p. 158, Liebenam (1) p. 543, Aubury (1) pp. 204, 213; *Mendocino,* Aubury (1) p. 137; *Modoc,* Tucker (3) p. 241; *Mono,* Hanks (12) pp. 158, 159, 259, (15) p. 105, Whiting (1) p. 364, Aubury (1) p. 243; *Napa,* Hanks (12) p. 158, (15) p. 105; *Nevada,* Hanks (12) p. 158,

Aubury (1) p. 27; *Placer*, Silliman (7) p. 351, Hanks (12) p. 158, (15) p. 105, Aubury (1) p. 173, (4) pp. 207. 210, C. A. Waring (4) p. 329; *Plumas*, Hanks (12) p. 158, Crawford (1) p. 69; *Riverside*, F. J. H. Merrill (2) p. 526, Tucker (8) p. 195, Woodford et al. (10) p. 371; *San Bernardino*, Aubury (1) p. 255, Tucker (4) p. 339; *Shasta*, Hanks (12) p. 158, (15) p. 105, Diller (10) p. 12, Laizure (1) p. 519; *Siskiyou*, S.M.B. (15679); *Trinity*, Hanks (12) p. 158, (15) p. 105, S.M.B. (15116), (15149), (4223), (4556); *Ventura*, Tucker and Sampson (20) p. 257; *Yuba*, Aubury (1) p. 172.

CUPRODESCLOIZITE

See descloizite

CUPROPLUMBITE

See galena

Riverside County: **1**, Reported as a mineral species distinct from galena from Black Eagle mine, Eagle Mountains, Tucker (8) p. 195, S.M.B. (19939). Shown to be identical with galena, Palache et al. (10) p. 200.

CUPROSCHEELITE

See scheelite

CUPROTUNGSTITE

Hydrous copper tungstate, $WO_3 \cdot 2CuO \cdot H_2O$

Cryptocrystalline, fibrous. Color green. H. = 4½.

Fresno County: **1**, A large crystal of unusual size originally described as cuproscheelite was sent from an unknown locality in Fresno County to San Francisco in 1879, Hanks (12) p. 159, (15) p. 105. It may have come from the Kern County locality.

Kern County: **1**, Material found with radiating black tourmaline at the Green Monster mine, 12 miles east of White River, was first reported as cuproscheelite, Hanks (2) p. 133. Later examination proved it to be scheelite with admixed cuprotungstite, Schaller (46) p. 237.

CURITE

See gummite

* CURTISITE, 1930

A hydrocarbon, $C_{24}H_{18}$

Probably orthorhombic. Granular. Perfect basal cleavage. Fracture conchoidal. Luster vitreous to adamantine. Color yellow to pistachio green. H. = less than 2. G. = 1.235-1.237.
Inflammable.

Lake County: **1**, Curtisite occurs with cinnabar and dolomite in serpentine at the Mirabel mine, near Middletown, Vonsen (p.c., '34). **2**, Curtisite is reported from the Helen and Research mines, Yates and Hilpert (4) p. 247.

Napa County: **1**, Curtisite has been found in the Knoxville mine, Averitt (1) p. 78.

San Francisco County: **1**, Curtisite occurs in a ledge of serpentine veined with chalcedony at Duboce Street, near Market Street, on the

site of the United States Mint in San Francisco, W. W. Bradley (24) p. 71, S.M.B. (20746).

Sonoma County: **1**, Curtisite was found with realgar, metacinnabar, and opal at Skaggs Springs. It was described and named by F. E. Wright and Allen (3) p. 169 (with analysis), also W. W. Bradley (24) p. 345, S.M.B. (20813), Everhart (4) p. 390.

CUSTERITE

$Ca_4Si_2O_7(OH,F)_2$

Monoclinic. Fine granular masses. Three cleavages (basal and prismatic). Color greenish gray. H. = 5. G. = 2.91.

Difficultly fusible. Dissolves with separation of gelatinous silica.

Riverside County: **1**, Custerite with idocrase was found by Tilley (1) p. 372 in a metamorphic rock from Crestmore.

CYANITE

See kyanite

CYANOSITE

See chalcanthite

CYRTOLITE

See zircon

$ZrSiO_4$, but containing U, Y, and other rare elements

Riverside County: **1**, From Southern Pacific quarry near Nuevo in radial clusters and individual crystals. Spectroscopic analysis shows silicon, zirconium, and yttrium in large quantities. Found with xenotime, monazite, and yttrocrasite (?) in pegmatite, Murdoch (19) p. 198.

San Bernardino County: **1**, Cyrtolite occurs with betafite in a dark mass in pegmatite north of Hector, Hewett and Glass (3) p. 1048.

DAHLLITE

See apatite

DAMOURITE

See muscovite

DANAITE

See arsenopyrite

DANBURITE

Borosilicate of calcium, $CaB_2Si_2O_8$

Orthorhombic. Habit prismatic, resembling topaz. Cleavage indistinct. H. = 7-7.25. G. = 2.97-3.02. Color pale to dark wine yellow, yellowish brown, colorless. Luster vitreous.

Fuses at 3.5 to a colorless glass. Not soluble in hydrochloric acid, but sufficiently decomposed to give the boron test with turmeric paper.

Riverside County: **1**, Danburite was identified by M. Vonsen on specimens from Crestmore, Eakle (20) p. 321.

DARAPSKITE

Hydrous sodium nitrate and sulphate, $NaNO_3 \cdot Na_2SO_4 \cdot H_2O$

Monoclinic. Square tabular crystals. Cleavages, two, perfect. Colorless. H. = 2.3. G. = 2.2.

Fuses with strong yellow flame. Heated in a bulb tube with potassium sulphate, it gives off red nitrous fumes. Barium chloride added to acid solution precipitates barium sulphate. Soluble in water. Yields water in a closed tube.

Nitro-glauberite is probably a mixture of darapskite and soda niter, W. E. Ford (8) p. 740.

San Bernardino County: **1,** Darapskite occurs in the niter beds of Death Valley, according to G. E. Bailey (2), p. 170.

DARK RUBY-SILVER ORE

See pyrargyrite

DATOLITE

Basic calcium borosilicate, $Ca_2B_2(SiO_4)_2(OH)_2$

Monoclinic. In small prismatic and tabular crystals; massive. Brittle. Vitreous luster. Color white, grayish, greenish. Streak white. H. = 5-5½. G. = 2.9-3.0.

Fuses easily to a clear glass and colors flame bright green. Gelatinizes with hydrochloric acid. Gives water in a closed tube.

Datolite forms veins of glassy crystals or white massive material in basic dikes and along the contact of igneous intrusions of diabase and diorite.

Colusa County: **1,** Datolite has been found with thomsonite, prehnite, etc., near Wilbur Springs, 2 miles east of the Lake County line, Vonsen (p.c., '33).

Inyo County: **1,** White massive datolite was found with idocrase and garnet at the San Carlos mine, 10 or 12 miles south of Fish Springs, and was analyzed by J. L. Smith (1) p. 435, Hanks (12) p. 159, Kunz (24) p. 97. **2,** It has been reported from the Slate Range, Kunz (24) p. 97.

Riverside County: **1,** Massive white glassy datolite, with a slight greenish tinge, occurs in a pegmatite at Crestmore, Eakle (15) p. 350, Foshag (12) p. 88.

San Bernardino County: **1,** Hanks (12) p. 97 reports datolite from the Calico Mountains.

San Francisco County: **1,** Glassy crystals and white veins of datolite occur in an altered diabase dike in the serpentine at Fort Point. Analyzed by Schaller. Rather complex crystals were measured by Eakle (1) p. 317. See also Kunz (24) p. 97.

DAWSONITE

Basic carbonate of aluminum and sodium, $Na_3Al(CO_3)_3 \cdot 2Al(OH)_3$

Orthorhombic. In thin crusts of white radiating acicular or bladed crystals. Perfect prismatic cleavage. H. = 3. G. = 2.4.

Swells and fuses, coloring flame deep yellow; fused mass gives an alkaline reaction. With cobalt nitrate gives a fine blue color. Gives water in a closed tube. Effervesces readily in acid.

Dawsonite is a very rare mineral, and occurs only in arid regions as white incrustations.

Inyo County: **1,** It is reported to occur as a soft earthy incrustation in a dike in Amargosa Canyon, G. E. Bailey (2) p. 102.

DESCLOIZITE

Lead and zinc vanadate, $4(Pb,Zn)O,V_2O_5 \cdot H_2O$

Orthorhombic. Short prisms. Drusy surfaces and crusts; also massive. Greasy luster. Color cherry red, yellowish brown, black. Streak orange to brownish red. H. = 3½. G. = 5.9-6.2.

Easily fusible. Blowpipe reactions are similar to those for vanadinite. Ammonia added to a nitric-acid solution may show the blue of copper. Reaction can also be obtained for zinc by heating coating on charcoal with cobalt nitrate. Gives a small amount of water in a closed tube.

Cuprodescloizite is a variety with about half of the zinc replaced by copper.

San Bernardino County: **1**, Minute colorless and yellowish plates of cuprodescloizite occur with cerussite and vanadinite at Camp Signal, Schaller (24) p. 149, (26) p. 88, and Cloudman et al. (1) p. 849.

DEWEYLITE

Hydrous magnesium silicate, $4MgO \cdot 3SiO_2 \cdot 6H_2O$

Amorphous. Massive, gum-like. Greasy luster. Color whitish, yellowish, reddish. H. = 2-3½. G. = 2-2.2.

Like serpentine in its reactions.

Napa County: **1**, Deweylite occurs as a gangue mineral with the gold and silver ores of the Palisades mine, 2 miles north of Calistoga, Hulin (p.c., '36).

Riverside County: **1**, A. F. Rogers (19) p. 584 and Daly (1) p. 651 have described the occurrence of deweylite with chrysotile in the East Chino quarry at Crestmore.

San Bernardino County: **1**, Mentioned from the Dewey mine, Clark Mountain district, in carbonate zone, Schaller (50) p. 816.

Santa Clara County: **1**, Crusts of deweylite have been found at the Western magnesite mine on Red Mountain, A. F. Rogers (7) p. 380.

DIADOCHITE

$2Fe_2O_3 \cdot 3(SO_3,P_2O_5) \cdot 15H_2O$

Amorphous. Massive. Vitreous. Yellow-brown. H. = 3. G. = 2.0.

San Benito County: **1**, Diadochite has been found in the New Idria quicksilver mine, A. F. Rogers (43) p. 178.

DIALLAGE

See Pyroxene

DIAMOND

Native carbon, C

Isometric. Octahedrons and hexoctahedrons common. Crystal faces often curved. Perfect octahedral cleavage. Brittle. Adamantine to greasy. Yellow and colorless crystals common. Red, orange, green, blue, brown, and black are rarer shades. H. = 10. G. = 3.5.

Unaffected by heat except at very high temperatures. Not acted on by acids or alkalies.

The extreme hardness and brilliant adamantine luster serve to distinguish diamond from quartz and other glassy minerals.

Bort is a hard rounded form without distinct cleavage. Unsuitable for gems. *Carbonado* is a hard black variety without cleavage.

Diamonds were found in California soon after placer mining began. As early as 1849, Lyman (3) p. 294 reported seeing a straw-yellow crystal about the size of a small pea, which came from one of the placers.

A few years later diamonds were observed in the gold gravels at Cherokee, Butte County, and this locality has become the most noted one in the state for the number found.

Placer deposits elsewhere have also yielded them from time to time, so their occurrence has not been limited to any one field. No record has been kept of the total number found, but it is probably between four and five hundred. Since all of them are chance finds, there can be no doubt that many more have been overlooked or destroyed.

A few of the stones found are over 2 carats in weight and of good quality, but the majority are small and mostly "off color," usually with a pale-yellow tinge. Most of these diamonds, now in the possession of different individuals, were found during the days when placer mining and hydraulicking were at their height, and since that time diamond finds have been less frequent.

In California, diamonds have been found only in placer gravels and in the black sands and concentrates of placer mines. Presumably their origin has been in the basic igneous rocks from which the serpentines of the gold regions have been derived. The discovery near Oroville of an apparent pipe of serpentinized rock bearing a resemblance to the diamond pipes of South Africa led to some active operations on the part of the United States Diamond Mining Company, and a shaft was sunk, which proved not successful, Sterrett (2) p. 1217. The rock is a hard eclogite differing in its character from the kimberlite of South Africa, Sterrett (2) p. 1217. Hanks (12) pp. 168-172 gives an interesting account of the diamonds found during the early days of gold mining, and Turner (20) and Storms (16) contribute short articles on California diamonds.

Occurrences of special mineralogical or commercial interest only are noted below.

Amador County: **1,** Among the 60 or 70 stones from Jackass Gulch near Volcano was found one single clear crystal of 1.57 carats and two small crystals showing the trapezohedron with curved faces, J. D. Whitney (7) p. 276. **2,** A stone (2.65 carats) with some crystal faces was found in 1934 near Plymouth, Sperisen (1) p. 39.

Fresno County: **1,** Small diamonds, reported to have been found near Coalinga, are probably quartz, and are popularly referred to as "Coalinga diamonds." No published references to this supposed occurrence have been found.

Nevada County: **1,** The largest diamond recorded from the state, weighing 7¼ carats was found at French Corral sometime before 1867, Hanks (10) p. 251, (12) p. 169; Kunz (24) p. 44.

Trinity County: **1,** Hanks (1) p. 162, records a description by Wohler of minute diamonds occurring with finely divided platinum, from near the junction of Klamath and Trinity Rivers.

DIASPORE

Hydrous aluminum oxide, $HAlO_2$

Orthorhombic. Prismatic crystals or foliated masses. Good cleavage. Very brittle. Brilliant luster. Colorless, white, gray, green, brown. H. = 6½-7. G. = 3.3-3.5.

Infusible and insoluble.

Calaveras County: **1,** Diaspore occurs in good crystals from 5 to 6 miles east of Altaville on Janokis Ranch, with chlorite on chromite (University of California collections, at Berkeley).

Diamonds found in California

County	Location	Date	Total number of stones	Weight of large stones in carats	References
Amador	Jackass Gulch (near Volcano)		60–70	1–1.57	J. D. Whitney (7) p. 276, Hanks (10) p. 253, (12) p. 169, Kunz (24) p. 40
	Raneheria (near Volcano)		1		Turner (20) p. 183
	Loafer Hill (near Oleta)		1		Turner (20) p. 183
	Near Plymouth	1934	1	2.65	Sperisen (1) p. 39
	Indian Gulch (near Fiddletown)	1855–67	5		Silliman (8) p. 354, Hanks (10) p. 250, Kunz (24) p. 40
Butte	Cherokee Flat	from 1853 on	300+	1–2.25	Silliman (8) p. 355, (12) p. 133, Kunz (24) pp. 41, 42, Hanks (12) p. 170, Waring and Huguenin (2) p. 87, Eng. & Min. Jour. (21) p. 589
		1867		1–1 3/16 cut	
		1892–93		2	
		1910	1	2	Sterrett (6) p. 859
		1912	1	1.08+	Sterrett (8) p. 1040
		1913	Several	1–1¼	Sterrett (9) p. 651
		1915	3	1 each	
		1916	1	1.2	Schaller (38) p. 892
		1918	1	.75	Schaller (39) p. 9
	Oroville		10		Kunz (24) p. 43, Sterrett (2) p. 1217
	Thompsons Flat (2 miles from Oroville	1915	9	3—1 each	
		1916	2	Value $125, $52	C. A. Waring (4) p. 187
	Yankee Hill (1½ miles northwest of Oroville	1861	1	1½ cut	Hanks (10) p. 252, (12) p. 171, Kunz (24) p. 42, W. W. Bradley (10) p. 669, (25) p. 16
Del Norte	Smith River			Microscopic size	Hanks (12) p. 170, Kunz (24) p. 43

El Dorado	Somewhere in county	Before 1873	12		Silliman (8) p. 355, Goodyear (2) p. 27
	Forest Hill	Before 1867	40–50	1–1.5	Silliman (5) p. 119, Kunz (24) p. 43
	White Rock Canyon, Cedar Ravine (near Placerville)		3–4	0.5, 1¼	Hanks (10) p. 250, (12) pp. 168, 169, Kunz (24) p. 44
	Webber Hill (south side)		3		Kunz (24) p. 169
	Smiths Flat		47+		B. Evans (1) p. 814
		1859–1874	20		
		1874	2	0.2, 0.12	
		1879	1	0.12	
		1894	1	0.92	
		1896	4	1.88, 0.25, 1.62, 1.06	
		1897	1	1.50	
		1899	1	0.65	
		1900	1	1.4+	
		1901	1	0.46	
		1912	1	0.95+	
Humboldt	Lower Trinity River				Min. & Sci. Press (13) p. 194
Imperial (?)	Along Mexican border				F. J. H. Merrill (1) p. 740
Nevada	French Corral		2	7¼, 1 3/5	Silliman (8) p. 355, Hanks (10) p. 251, (12) p. 169, Kunz (24) p. 44
Placer			Several	Small	Min & Sci. Press (13) p. 194
Plumas	Gopher Hill and upper Spanish Creek		2		Kunz (24) p. 31, W. W. Bradley (10) p. 669
	Sawpit Flat		1		Sterrett (9) p. 651
	Nelson Point		1	2	Kunz (14) p. 423
Trinity	Near junction of Trinity and Klamath Rivers		Many, minute		Kunz (24) p. 44, Hanks (1) p. 162, (12) p. 310
Tulare	Alpine Creek	1895	1		Kunz (11) p. 896

Fresno County: **1**, Diaspore occurs in small crystals with spinel in metamorphosed limestone at Twin Lakes, Chesterman (p.c. '55).

Mono County: **1**, Diaspore occurs in compact masses with andalusite or in veins of pyrophyllite at the mine of Champion Sillimanite, Incorporated, on the western slope of the White Mountains, 7 miles east of Mocalno, Kerr (3) p. 626.

DIATOMACEOUS EARTH

See opal

DIATOMITE

See opal

DIOPSIDE

See pyroxene

DIOPTASE

H_2CuSiO_4

Hexagonal, tri-rhombohedral. Commonly in prismatic crystals; also massive. Perfect rhombohedral cleavage. Color emerald green; luster vitreous. H. = 5. G. = 3.28-3.35.

Mono County: **1**, Dioptase is tentatively identified from the Cornucopia mine in the Blind Spring Hill district as crystals lining cavities in malachite. No tests have been made to confirm the identification, A. L. Ransome (2) p. 191.

San Bernardino County: **1**, Dioptase occurs with linarite and caledonite on specimen from a mine on Silver Lake Mountain, Murdoch (p.c. '49), S.M.B. (21350).

DISTHENE

See kyanite

DOLOMITE

Carbonate of calcium and magnesium, $CaMg(CO_3)_2$

Hexagonal-rhombohedral. Crystals usually with curved faces; also granular, coarse or fine. Cleavage perfect rhombohedral. Brittle. Vitreous luster. Color white, pink, green, brown, gray, black. H. = $3\frac{1}{2}$-4. G = 2.8-2.9.

Powder effervesces in cold dilute acids. Best distinguished from calcite in the wet way. After removal of the calcium by its precipitation with ammonium oxalate, the magnesium is obtained from the filtered solution by precipitating with sodium phosphate.

Dolomite is a common mineral, but is not as abundant as calcite. Much of the limestone and marble of the state is dolomitic. Dolomite is commonly associated with serpentine and other magnesian rocks, in which it is often found as white veins. Occurrences of mineralogic interest only will be noted.

Amador County: **1**, Narrow veins of dolomite traversing chloritic rocks carry free gold, Hanks (12) p. 177.

Calaveras County: **1**, White crystals of dolomite occurred in the gold-bearing schist of Carson Hill, S. M. B. (13140). **2**, Dolomite is found in fine crystals lining cavities and massive with free gold from Winter Hills mine near Angels Camp, Hanks (12) p. 177.

Kern County: **1**, Found replacing wood in Midway oil field, Adams (1) p. 357.

Lake County: **1,** Well-crystallized dolomite occurs as gangue of mercury ores in the Mirabel (Standard) mine (T. 10 N., R. 7 W., M. D.), W. W. Bradley (28) p. 393.

Los Angeles County: **1,** Crystals occur with pyrite, marcasite (?), and other minerals in the Lomita Quarry, Murdoch (p.c. '54).

San Bernardino County: **1,** Gold-bearing dolomite is reported from the Amargosa mine, Hanks (12) p. 177.

Santa Clara County: **1,** Veins of coarsely bladed dolomite associated with opalized chalcedony and some cinnabar are reported from the Hillsdale (also called Oak Hill, San Juan Bautista, Chapman or Chaboya) mine on the east slope of Oak Hills, 4 miles south of San Jose, Crittenden (1), p. 63.

DUFRENOYSITE

Lead arsenic sulphide, $Pb_2As_2S_5$

Monoclinic. Generally massive. Cleavage one direction perfect. Brittle. Metallic luster. Color dark lead gray. Streak reddish brown. H. = 3. G. = 5.55-5.57.

Like jamesonite in its reactions, except that the more volatile fumes of arsenic trioxide, instead of those of antimony, are given off.

Inyo County: **1,** Dufrenoysite was reported to have been found in the Cerro Gordo district, Hanks (12) p. 178.

DUMORTIERITE

Basic aluminum borosilicate, $Al_8BSi_3O_{19}(OH)$

Orthorhombic. In small prisms. Massive, granular, fibrous. Cleavage one direction distinct. Vitreous luster. Color smalt blue, dark blue, violet red. H. = 7. G. = 3.26-3.36.

Infusible and insoluble. Fused on platinum wire with a mixture of potassium bisulphate and fluorite will give a momentary green flame.

Imperial County: **1,** Boulders of dark-blue dumortierite occur over a wide area about 10 miles northeast of Ogilby, Kunz (10) p. 697, (24) p. 71, Tucker (11) p. 269, and Wolff (1) p. 188. (The locality is described incorrectly in some of these references).

Kern County: **1,** Dumortierite has been reported in the heavy-mineral assemblage of drill cores from wells in the Lazard area of the Lost Hills (T. 27 S., R. 20 E., M. D.), Reed and Bailey (4) p. 363.

Riverside County: **1,** Murphy (1) p. 80 reports dumortierite in quartz monzonite, a rock resembling granite, just west of the railroad trestle near the mouth of Temescal Wash, 2 miles southeast of Corona. See also Larsen (17) p. 106. **2,** He has also reported the occurrence of dumortierite in granodiorite near the Cajalco tin mine, 13 miles southwest of Riverside, ibid. p. 79. **3,** Minute blue needles of dumortierite occur in the andalusite pegmatite at the magnesite mine, Winchester, Murdoch (p.c. '46).

San Diego County: **1,** Violet-red dumortierite occurs near Dehesa, with sillimanite in quartz, and was described and analyzed by Schaller; also analyzed by Ford, Kunz (24) p. 71, Schaller (7) p. 211; analyses by W. E. Ford (2) p. 427 and Schaller (7) p. 211.

DURDENITE

See emmonsite

† EAKLEITE, 1917

See xonotlite

EDENITE

See amphibole

EDINGTONITE

Perhaps $BaAl_2Si_3O_{10}\cdot 3H_2O$

Orthorhombic, crystals pyramidal in habit. H. = 4.4. G. = 2.69.

Mendocino County: **1**, Found on Ash Creek, 1 mile northeast of highway on or near the Sonoma County line, with brewsterite, Vonsen (p.c. '45).

EGLESTONITE

Mercury oxychloride, Hg_4Cl_2O

Isometric. Minute crystals. Resinous to adamantine luster. Color yellowish brown, changing to black. H. = 2.3. G. = 8.327.

Volatilizes completely and does not give water in the closed tube.

San Mateo County: **1**, Minute yellow crystals of eglestonite associated with cinnabar, mercury, calomel, dolomite, magnesite, opal, and quartz occur about 5 miles west of Palo Alto in seams and cavities in the siliceous material so common in the serpentine of the cinnabar districts, A. F. Rogers (5) p. 48, W. W. Bradley (5) p. 149.

EL DORADOITE

See quartz

ELECTRUM

See gold, var. Argentian gold

* ELLESTADITE, 1937

An apatite-like sulphate-silicate, with SO_4 and SiO_4 in place of PO_4
$Ca_5(Si,S,P,CO_4)_3(Cl,F,OH)$

Hexagonal, prismatic crystals. H. = 5. G. = 3.068. Cleavage indistinct. Color pale rose.

This mineral was noted in Bulletin 136 as a variety of wilkeite but should have species rank.

Riverside County: **1**, Pale rose stringers associated with wollastonite, vesuvianite, diopside, etc., at Crestmore, McConnell (1) p. 977. Analysis by R. B. Ellestad, ibid. . . . p. 983, shows 20.69 percent SO_3 and 17.31 percent SiO_2.

EMBOLITE

Silver chloro-bromide, $Ag(Br,Cl)$

Isometric. Generally massive. Sectile. Resinous luster. Color grayish green, yellow. H. = 1-1½. G. = 5.31-5.43.

Heated in a closed tube with potassium bisulphate and pyrolusite, red vapors of bromine are set free. Heated in closed tube with galena, yellow lead bromide forms, which turns white on cooling. Silver nitrate will precipitate silver bromide from a nitric-acid solution.

Embolite has been found only in association with cerargyrite and in much smaller amounts.

Inyo County: **1**, Embolite is found with cerargyrite in the Indiana mine, near Swansea, Hanks (12) p. 178. **2**, At the Lee mine, 18 miles east of Keeler, Tucker (11) p. 488. **3**, From Panamint mines in Sur-

prise Canyon 10 miles northeast of Ballarat, Tucker (10) p. 495. **4,** From the Minnietta district (T. 19 S., R. 42 E., M. D.), Tucker and Sampson (25) p. 445.

Mono County: **1,** Embolite is reported from the Minnie mine, Sweetwater Range, Hanks (12) p. 178. **2,** From the Silver Reef mine in Long Valley (T. 3 S., R. 30 E., M. D.), R. J. Sampson (14) p. 146.

San Bernardino County: Embolite is reported **1,** from the Alhambra mine, Calico district, Hanks (12) p. 178 and (15) p. 107, and as well-formed crystals in Wall Street Canyon, Calico district, D. J. Henry (1) p. 228. **2,** from the Death Valley mine, 3 miles east of Cima on the northeast slope of the New York Mountains, Tucker and Sampson (16) p. 275, (17) p. 349; **3,** from the Silver Reef district, Storms (4) p. 367; **4,** from the Oro Plata mine in the Old Woman Mountains (sec. 23, T. 3 N., R. 19 E., S. B.), Tucker and Sampson (17) p. 354; **5,** from the War Eagle mine, Lead Mountains (T. 4 N., R. 10 E., S. B.), 9 miles south of Bagdad, Tucker (8) p. 95; **6,** from the Clark Mountain district (T. 18 N., R. 13 E., S. B.), Tucker (8) p. 94; **7,** from Trojan Lake district 22 miles northwest of Fenner, Tucker (4) p. 364; **8,** reported by De Groot (2) p. 537 from Searles Lake.

EMERALD

See beryl

EMMONSITE

Hydrated ferric tellurite, perhaps $Fe_2(TeO_3)_3 \cdot 2H_2O$

Frondel and Pough (1) p. 215 have shown that durdenite and emmonsite are identical and suggest the retention of the latter name.

Calaveras County: **1,** A specimen of telluride ore from this county, presumably from Carson Hill, contained along its fractures pale greenish-yellow spherulites, which on optical examination Larsen (5) p. 45 and (11) p. 71 identified as durdenite.

ENARGITE

Copper arsenic sulphide, $Cu_3(As,Sb)S_4$

Orthorhombic. Crystals and massive. Cleavage perfect prismatic. Brittle. Metallic luster. Color and streak grayish black. H. = 3. G. = 4.4. Antimony up to 6 percent.

Fuses and gives a faint coating on charcoal. The roasted mineral can be reduced to metallic copper by fusion with sodium carbonate. The borax bead is blue. Soluble in nitric acid with the precipitation of a small amount of antimony trioxide.

Alpine County: **1,** Enargite was found in large masses associated with massive pyrite in the Mogul district, and formed the chief copper mineral of the Morning Star and a few other mines, E. W. Root (1) p. 201, Silliman (12) p. 126, Eakle (9) p. 232, (16) p. 12.

Del Norte County: **1,** Enargite has been reported with bornite from French Hill (N. R.).

El Dorado County: **1,** Enargite was found in the Ford mines, near Georgetown (N. R.).

Plumas County: **1,** Small amounts of enargite occur with bornite and chalcopyrite at Engels, Graton and McLaughlin (4) p. 15.

ENSTATITE

See pyroxene

EPIDESMINE

See stilbite

EPIDOTE

Basic calcium, aluminum, and iron silicate, $Ca_2(Al,Fe)_3(SiO_4)_3(OH)$

Monoclinic. Crystals usually prismatic. Massive, fibrous, earthy. Cleavage perfect basal. Brittle. Vitreous luster. Color pistachio green, dark green, dark brown, yellow. H. = 6-7. G. = 3.25-3.5.

Similar to zoisite in its reactions, but fuses to a black slag.

Epidote is a very common mineral in the state, especially as a secondary mineral in crystalline rocks. It is often found in aggregates of large crystals and columnar masses in veins with quartz and feldspar. It is abundant in contact-metamorphic deposits in limestone.

Butte County: **1**, Epidote was mentioned by Silliman (13) p. 385, (12) p. 133, as a constituent of the gold washings at Cherokee.

Calaveras County: **1**, It was found with garnet, quartz, and idocrase at Garnet Hill, just above the confluence of Moore Creek and the Mokelumne River, Turner (12) p. 706, Melhase (6) p. 7. **2**, Large crystals of epidote were found at Bald Point on the Mokelumne River, Kunz (24) p. 99. **3**, It was found at Mokelumne Hill (N. R.), and **4**, at Copperopolis (N. R.). **5**, It was found in good crystals with quartz 7 miles north of Angels Camp, Woodhouse (p.c. '45).

Colusa County: **1**, Green epidote is associated with hematite in a deposit 4 miles south of Lodoga (N. R.).

El Dorado County: **1**, Fine large crystals of epidote, coated with axinite, occurred in a coarse vein with orthoclase, bornite, and molybdenite at the old Cosumnes copper mine, Schaller (18) p. 42. **2**, Granular aggregates of epidote occur in the schists at Mount Tallac and near Grass Lake, Clark (p.c. '35).

Fresno County: **1**, It is common on Grub Gulch, S. M. B. (13525). **2**, It occurs as a contact mineral with quartz and garnet near Trimmer (N. R.). **3**, Crystals up to 10 inches have been found in the north end of Clarks Valley, Noren (p.c. '35). Other occurrences: Tucker and Sampson (30) p. 565, Chesterman (1) p. 278.

Humboldt County: **1**, Large prisms of epidote with calcite occur in schists on the west side of Horse Mountain (N. R.).

Inyo County: **1**, It is common in the contact zones of the tungsten deposits near Bishop, Knopf (6) pp. 233-238, Hess and Larsen (17) pp. 269, 276, Lemmon (5) p. 504. **2**, It occurs abundantly in the contact zone at Darwin, Kelley (4) p. 539.

Kern County: **1**, Epidote was found with scheelite at the Cadillac claims in the Greenhorn mining district, Storms (15) p. 768. **2**, Abundant crystals were found at the Aldridge mine (NW$\frac{1}{4}$ sec. 27, T. 25 S., R. 32 E., M. D.), Durrell (p.c. '45). **3**, Coarsely crystalline epidote in quartz comes from Black Mountain, Durrell (p.c. '45).

Lassen County: **1**, It occurs with native copper at the Lummis mine (N. R.).

Los Angeles County: **1**, It was found with bitumen and orthoclase at White Point, S. M. B. (8688). **2**, It is disseminated through crystalline limestone in Pacoima Canyon, 3$\frac{1}{2}$ miles from San Fernando, Goodyear (3) p. 340.

Madera County: **1**, Epidote is widespread in the Ritter Range, Erwin (1) p. 67. **2**, It is the most abundant silicate mineral in the meta-

morphosed limestone of Shadow and Johnson Creeks, ibid. **3,** It occurred with quartz, hematite, and magnetite in the Hildreth mining district, Erwin (p.c. '34). **4,** Specimens of epidote have come from Coarse Gold, Kunz (24) p. 99.

Marin County: **1,** Epidote occurs with lawsonite near Reed Station, F. L. Ransome (3) p. 310.

Mariposa County: **1,** Massive epidote occurs at Hornitos (N. R.). **2,** It occurs on the south side of Mount Hoffman, Kunz (24) p. 99.

Mendocino County: **1,** Gray-colored blades of epidote (or clinozoisite) up to 24 inches occur with lawsonite and rutile on the new Covelo road, Vonsen (p.c. '45).

Mono County: **1,** Massive epidote occurs at Epidote Peak at the head of the East Fork of Green Creek (N. R.). **2,** Crystals occur in veins at the Morris claims, Benton Range, Lemmon (6) p. 591. **3,** With garnet at Yellow-Jacket Spring, A. L. Ransome (2) p. 191. **4,** At Black Rock mine (T. 3 S., R. 31 E., M. D.), R. J. Sampson (14) p. 147.

Nevada County: **1,** It was found at Meadow Lake, Lindgren (5) p. 205. **2,** It occurred with quartz and calcite at the Oustomah mine (N. R.).

Plumas County: **1,** Epidote was found with garnet and quartz on Mount Herbert (N. R.). **2,** It occurs with garnet at a contact of limestone and granodiorite at the Cosmopolitan and Duncan mines in the Genesee district (N. R.). **3,** It occurs with bornite and chalcopyrite at Engels, Graton and McLaughlin (4) p. 20.

Riverside County: **1,** Deep-green epidote occurs in the calcite, and long prismatic epidote crystals, altered brown, occur in the pegmatite at Crestmore, Eakle (15) p. 349, Woodford et al. (1) p. 358. **2,** Epidote was found with specular hematite in the Monte Negras mining district, Storms (4) p. 369. **3,** It occurs in gneiss on the Eagle Mountains, Harder (6) p. 48, F. J. H. Merrill (2) p. 545. **4,** Epidote crystals over half a foot in length have been found in quartz near Allessandro, Foshag (p.c. '35). **5,** Epidote occurs with axinite and prehnite in the old city quarry in Fairmont Park, Riverside, A. F. Rogers (7) p. 380. **6,** Clear crystals 1 inch by $\frac{1}{8}$ inch were found near Hemet, Kunz (23) p. 942. **7,** Epidote, with scheelite and garnet occurs at the Carr tungsten mine (sec. 31, T. 8 S., R. 3 E., S. B.), Tucker and Sampson (8) p. 48. **8,** Considerable massive epidote occurs in copper claims in the Palen Mountains, 2 miles south of Packards Well, Aubury (1) p. 256. **9,** Clear slender crystals of epidote occur with quartz in a pegmatite on Alder Creek, a tributary of Coyote Creek, Durrell (p.c. '44).

San Bernardino County: **1,** It occurs coarsely crystalline with calcite at a contact of granodiorite and limestone in the Morongo district (N. R.). **2,** It occurs with specular hematite 17 miles northwest of Needles (N. R.). **3,** It was found with garnet, magnetite, and hematite in the iron-ore deposit near Dale, Harder, and Rich (4) p. 237. **4,** It occurs in boulders in the lower part of Badger Canyon (secs. 4, 9, T. 1 N., R. 4 W., S. B.) about 5 miles north of San Bernardino, Garner and Wilke (p.c. '36). **5,** Small amounts of epidote occurs in vesicles of lava boulders on an alluvial fan south of Daggett, Murdoch and Webb (11) p. 553. **6,** Epidote occurs with garnet and scheelite in the Shadow Mountain mines (secs. 30, 31, T. 8 N., R. 6 W., S. B.), Tucker and Sampson (27) p. 78. **7,** With scheelite in secs. 8, 9, T. 5 N., R. 17 E., S. B., Tucker and Sampson (32) p. 68.

San Diego County: **1**, Epidote occurs as a secondary mineral with black tourmaline at Rincon, A. F. Rogers (4) p. 213. **2**, Clear, transparent epidote crystals of gem quality occur at the McFall mine, 7½ miles southeast of Ramona, Kunz (24) p. 99.

San Luis Obispo County: **1**, It occurs with quartz, pyrite, and calcite near La Panza (N. R.).

Siskiyou County: **1**, It was found with dark-brown garnet and quartz on the South Fork of Coffee Creek (N. R.). **2**, It occurs in schist near Seiad, (N. R.). **3**, Crystals of epidote occur in the ore of the King Solomon mine, Goudey (p.c. '36).

Sonoma County: **1**, Epidote occurs in glaucophane schist near Healdsburg (N. R.).

Trinity County: **1**, Green epidote associated with colorless garnet, sphene, and zircon, occurs in a soda granite-porphyry in the Iron Mountain district, Weaverville quadrangle (N. R.). **2**, It was found with calcite at Douglas City (N. R.). **3**, It occurs as a contact mineral with garnet in the limestone at Red Mountain (N. R.).

Tulare County: **1**, It is common in the Mineral King district, Goodyear (3) p. 646, Franke (1) p. 469. **2**, Large divergent-columnar masses of epidote occur at Eber Flat, S. M. B. (11124). **3**, In crystals up to 4 inches at Three Rivers, W. O. Jenkins (1) p. 172. **4**, Epidote is also common in Frazier Valley, Goodyear (3) p. 644. **5**, Massive epidote was found with quartz and garnet on a hill between Drum Valley and Slickrock Canyon, and on the west side of the valley of Sheep Creek, Durrell (p.c. '35).

Tuolumne County: **1**, Epidote occurs in contact rock in the Confidence district (secs. 11, 14, T. 2 N., R. 16 E., M. D.), Little (1) p. 287.

EPISTILBITE

$Ca_5NaAl_{11}Si_{29}O_{80}\cdot25H_2O$

Monoclinic. Habit prismatic. Radiated spherical aggregates; granular. One perfect cleavage. H. = 4. G. = 2.25. Easily fusible.

Riverside County: **1**, Flaky, feathery epistilbite occurs replacing feldspar at the Southern Pacific silica quarry near Nuevo, Murdoch (p.c., '45).

EPSOMITE—Epsom Salt

Hydrous magnesium sulphate, $MgSO_4\cdot7H_2O$

Orthorhombic; disphenoidal. Usually in bunches of long slender fibers and fibrous crusts. One perfect cleavage. Vitreous to earthy luster. Color and streak white. H. = 2-2½ .G. = 1.75.

Soluble in water. Taste bitter and salt.

Efflorescences of epsomite are common in caves and tunnels where pyrite or other sulphides are decomposing in the presence of magnesian rocks. Long hair-like masses of epsomite are common in the cinnabar mines of the state. Commercial epsom salt is produced as a by-product in the evaporation of the bitterns of sea water.

Alameda County: **1**, Epsomite occurs as an efflorescence on the walls of the pyrite mines of Leona Heights, Schaller (1) p. 216.

Amador County: **1**, It was common in the mines on Copper Hill (N.R.).

Contra Costa County: **1**, It was found at the Mt. Diablo mine (SE¼ sec. 29, T. 1 N., R. 1 E., M. D.), C. P. Ross (2) p. 42.

Imperial County: **1**, It was mentioned by Emory (1) p. 102, as occurring in white crusts near the head of Cariso (Carrizo) Creek, on the west side of the Colorado Desert.

Inyo County: **1**, Epsomite occurs with alunogen in clay at the mine of the American Magnesium Company in the Wingate district, near Ballarat, Hewett, et al. (1) p. 96.

Kings County: **1**, Epsomite is reported from old cinnabar mines at the head of Avenal Creek, Noren (p. c., '36).

Lake County: **1**, It was abundant in the old Abbott quicksilver mine, S.M.B. (15497). **2**, Epsomite, associated with copiapite, jarosite, and other minerals, is common at Sulphur Bank, Everhart (1) p. 136.

Los Angeles County: **1**, It has been found near Point Firmin, S.M.B. (8306).

Mariposa County: **1**, It was found as fine fibers in the Purchase mine near Donovan (N.R.).

Napa County: **1**, Epsomite was abundant in long white fibers (up to 1 foot in length) in the tunnels of the old Redington mine, Friedrich (1) p. 22, Becker (4) p. 389, Kramm (1) p. 345. **2**, Extensive deposits of epsomite occur at the Oat Hill mines, Fairbanks (3) p. 66.

San Benito County: **1**, Crusts of long fibers of epsomite, occasionally cut by later cinnabar veinlets, occur at the New Idria mine, Becker (4) p. 306.

San Bernardino County: **1**, An extensive deposit of epsomite is described, approximately in T. 19 N., R. 3 E., S.B., by Jahns (4).

Santa Barbara County: **1**, Colorless tufts and masses of epsomite have been found in a tunnel at Point Rincon, H. C. Ford (1) p. 55, Arnold and Anderson (3) p. 752.

Santa Clara County: **1**, Epsomite is abundant on the walls of the New Almaden and other cinnabar mines, S.M.B. (13449).

Solano County: **1**, Epsomite (?) is reported in tunnels at the St. John mine (sec. 33, T. 4 N., R. 3 W., M. D.), Aubury (2) p. 95.

Sonoma County: **1**, Goldsmith (7) p. 265, reported epsomite as incrustations and stalactites, with boussingaultite, at The Geysers; see also Allen and Day (2) p. 39. Vonsen (6) p. 290.

ERUBESCITE
See bornite

ERYTHRITE—Cobalt Bloom
Hydrous cobalt arsenate, $Co_3As_2O_8 \cdot 8H_2O$

Monoclinic. Crystals prismatic. Incrustations, earthy. One perfect cleavage. Sectile. Pearly to adamantine luster. Color and streak crimson to gray. H. = 1½-2½. G. = 2.95.

Gives a gray coating of arsenic oxide on charcoal. A little of the well-roasted powder fused in borax bead, gives the fine blue bead of cobalt. Yields water in closed tube. Soluble in hydrochloric acid.

Coatings and incrustations of erythrite are common on primary cobalt minerals, and often serve to locate cobalt.

Calaveras County: **1**, Erythrite occurs with smaltite in a stringer between schist and quartzite in the NW¼ sec. 21, T. 4 N., R. 14 E., M. D., Logan (7) p. 4, Hess (19) p. 451.

Inyo County: **1**, Erythrite occurs with annabergite, argentite, etc., at the Bishop silver-cobalt mine (sec. 14, T. 9 S., R. 31 E., M. D.) east of Long Lake, Tucker and Sampson (25) p. 378. **2**, It was reported from the Cerro Gordo region, R. W. Raymond (1) p. 29.

Lassen County: **1**, Erythrite is reported with smaltite and annabergite from the county, S.M.B. (9981).

Los Angeles County: **1**, Coatings of erythrite with smaltite, argentite, and barite occurred at the old Kelsey and O. K. mines near the San Gabriel Canyon, W. P. Blake (24) p. 207, (27) p. 163, Irelan (4) p. 47, Storms (4) p. 245. W. P. Blake (23) p. 376, reported it from the "Bernardino Range," which is probably this same locality. This locality is reported erroneously as "near Compton" in some references.

Mariposa County: **1**, It was found in rock seams with danaite at the Josephine mine, Bear Valley, Turner (3) p. 468, (12) p. 679.

Napa County: **1**, It occurs with smaltite in serpentine and chlorite in the Berryessa Valley (N.R.).

San Diego County: **1**, Erythrite occurs with limonite and morenosite at the Friday mine, in the Julian district, Hudson (1) p. 214.

San Luis Obispo County: **1**, Cronise (1) p. 593 reports it from near San Luis Obispo.

Siskiyou County: **1**, Erythrite is reported from Callahan, W. W. Bradley (28) p. 497, as coatings on smaltite.

Tuolumne County: **1**, Erythrite occurs associated with arsenopyrite in the Josephine mine, Logan (16) p. 189.

ESSONITE

See garnet

EUCAIRITE

Selenide of copper and silver, CuAgSe

Massive and granular. Somewhat sectile. H. = 2½. G. = 7.6-7.8. Color between silver white and lead gray. Streak shining. Fuses readily with production of Se fumes. Soluble in boiling nitric acid.

Calaveras County: **1**, "Gray copper" showing selenium instead of sulphur on analysis, may perhaps be referred to this species. It occurs at the Willard Mining Company property, in the Murphys mining district, Irelan (1) p. 37.

EUXENITE

An oxide of rare earth metals, including yttrium, cerium, uranium, and thorium, with calcium, $(Y,Ca,Ce,U,Th)(Cb,Ta,Ti)_2O_6$

Orthorhombic. Stout prismatic crystals, commonly in parallel and subparallel semi-radial aggregates, also massive. Twinning common. Fracture subconchoidal to conchoidal. H. = 5½-6½. G. = 5. Luster brilliant, submetallic, to greasy and vitreous. Color black, with a greenish or brownish tint. Streak yellowish, grayish, or reddish brown. Transparent in thin splinters.

San Bernardino County: **1**, Euxenite occurs with ilmenite, monazite, and allanite in the Pomona Tile quarry on the road between Old Woman Spring and Yucca Valley, Hewett and Glass, (3) p. 1048. It appears in small tabular crystals 3-8 mm. in diameter near the quartz nucleus of the pegmatite.

FAMATINITE—Luzonite

Copper antimony sulphide, $Cu_3(Sb,As)S_4$

Crystal system uncertain. Usually massive, intergrown with enargite. H. = 3½. G. = 4.5. Color gray with tinge of copper red. In polished section various shades of pale pink, showing multiple twinning, like a plagioclase. Distinguished from enargite by lack of cleavage, and pinkish tone. Gives test for antimony on charcoal. May have some arsenic.

Alpine County: **1**, Famatinite is found associated with enargite at the Morning Star mine, Mogul (Loope) district, Eakle (16) p. 12, Harcourt (1) p. 521.

Inyo County: **1**, Microscopic grains of famatinite have been found in polished sections of ore from the Darwin district, Kelley (4) p. 544.

FAYALITE

Iron silicate, Fe_2SiO_4

See also olivine and forsterite

Orthorhombic. Mostly in small crystals. Cleavage distinct. Vitreous luster. Color yellow, brown, black. H. = 6½. G. = 4.1.

Infusible. Soluble in hydrochloric acid; yields gelatinous silica on evaporation.

Imperial County: **1**, At Obsidian Butte, near Niland, lithophysae in the obsidian carry occasional crystals of fayalite, A. F. Rogers (42) p. 328.

Inyo County: **1**, Small brown crystals of fayalite occur with cristobalite, tridymite, and orthoclase in spheroidal openings in obsidian near Coso Hot Springs, Rutley (1) p. 427, A. F. Rogers (23) p. 215, Murdoch and Webb (11) p. 554 (crystal description).

Siskiyou County: **1**, Fayalite occurs with cristobalite in lithophysae in spherulitic obsidian near Canyon Butte (sec. 13, T. 44 N., R. 4 E., M. D.), C. A. Anderson (p. c. '35).

FELDSPARS

The name feldspar is given to a group of silicates of aluminum and sodium, calcium, potassium, or barium, similar in hardness, cleavage, specific gravity, and twinning.

The following classification of the feldspars shows the relationship of the varieties:

Orthoclase
  Soda orthoclase
Hyalophane
Celsian
Microcline
  Soda microcline
Anorthoclase
"Plagioclase feldspars"
  Albite molecule = *ab* ($NaAlSi_3O_8$)
  Anorthite molecule = *an* ($CaAl_2Si_2O_8$)

	ab	*an*
Albite	100-90	0- 10
Oligoclase	90-70	10- 30
Andesine	70-50	30- 50
Labradorite	50-30	50- 70
Bytownite	30-10	70- 90
Anorthite	10- 0	90-100

Feldspars are the most abundant and important of rock-forming silicates, and the classification of igneous rocks depends partly upon the feldspar of the rock. The albite-anorthite feldspars are commonly called the plagioclase feldspars, and in many petrographic descriptions this name is used, so that the particular kind of feldspar is not designated. As rock-forming minerals, the feldspars are too widely distributed to list all localities.

ALBITE

Sodium and aluminum silicate, $NaAlSi_3O_8$

Triclinic. Crystals tabular and elongated, common as repeated twins. Often massive. Two perfect cleavages. Brittle. Vitreous luster. Often very glassy. Colorless and white. Streak uncolored. H. = 6-6½. G. = 2.61-2.62.

Fuses at 4 and imparts a bright-yellow color to flame. Insoluble in acid.

Cleavelandite is a platy variety of albite, common in pegmatite dikes.

Albite is a common constituent of granites, rhyolites, granodiorites, and diorites; also metamorphic gneisses and schists. It forms very prominent white veins in the crystalline schists of the Coast Ranges and the Sierra Nevada.

Calaveras County: **1**, Well-formed crystals of albite were found in the Winters vein, Angels Camp; analyzed by Genth (3) p. 255. **2**, Crystals of albite line vugs at the Stanislaus mine, and are penetrated by crystals of millerite, A. W. Jackson (3) p. 365.

Contra Costa County: **1**, Veins of white albite cut the actinolite schists at San Pablo, Blasdale (1) p. 345.

Los Angeles County: **1**, Good transparent crystals of albite up to 1 inch across have been found in a pegmatite near Howlands Landing, Santa Catalina Island, Murdoch (p. c. '45). **2**, Well developed crystals of albite occur in chlorite-lawsonite schist at the western tip of Santa Catalina Island, Woodford (1) p. 55.

Marin County: **1**, Albite crystals up to 1 cm in size occur in lawsonite schist near Reed Station, Schaller (19) p. 48.

Mono County: **1**, Well-defined crystals of albite up to 4 inches in size occur with quartz at the Standard mine, Bodie. The crystals are often shells studded internally with fine quartz prisms, R. G. Brown (1) p. 344, Turner (30) p. 795.

Placer County: **1**, Fine crystals were found in the Shady Run mine 8 miles east of Dutch Flat. Reid (1) p. 280.

Plumas County: **1**, White dikes in serpentine at Meadow Valley are composed wholly of albite, Wheeler (2) p. 379.

San Benito County: **1**, Cleavelandite has been reported from Santa Rita Creek, W. W. Bradley (p. c. '44). **2**, Druses of some of the veins at the benitoite locality have yielded crystals of albite up to 10 millimeters in size, Louderback and Blasdale (5) p. 361.

San Diego County: **1**, Dark-colored manganese-bearing albite has been found in the Caterina mine, Pala, Kraus and Hunt (2) p. 466. **2**, Good small albite crystals are found in the pegmatites at Rincon, A. F. Rogers (4) p. 210. **3**, Well-crystallized cleavelandite occurs at the following gem-tourmaline localities: Pala, Donnelly (3) p. 10; Mesa Grande, Kunz (24) p. 137; Ramona, Kunz (24) p. 47; near Aguanga, Mountain Lily mine, Murdoch and Webb (p.c., '45).

ANDESINE

Sodium, calcium, and aluminum silicate, $m NaAlSi_3O_8$ with $n CaAl_2Si_2O_8$, intermediate between albite and anorthite

Triclinic. Crystals similar to albite. Commonly massive or compact. Cleavages as in albite. Colorless. H. = 5.6. G. = 2.66-2.68.

Same reactions as for oligoclase.

Andesine is a constituent of diorite, gabbro, andesite, and related rocks.

No unusual occurrences of andesine are recorded in the state.

ANORTHITE

Calcium and aluminum silicate, $CaAl_2Si_2O_8$

Triclinic. Generally in small crystals as a rock constituent. Properties like oligoclase and labradorite. H. = 6. G. = 2.74-2.76.

Fuses at 5. Soluble slowly and yields gelatinous silica. Gives the red flame of calcium.

Anorthite is a constituent of the very basic igneous rocks.

Lake County: **1**, Fine cleavage fragments of anorthite have been collected 2 miles northeast of Middletown along the highway to Lower Lake (N. R.).

CELSIAN

Barium and aluminum silicate, $BaAl_2Si_2O_8$

Monoclinic. Usually massive. Cleavage and twinning like orthoclase. Vitreous luster. Colorless. H. = 6-6½. G. = 3.37.

Distinguished from other feldspars by greater density or test for barium.

Celsian is not so common as the other feldspars and has been reported from only one locality in this state.

Mariposa County: **1**, Celsian was found with sanbornite and gillespite in veins in quartzite, 1 mile north of Trumbull Peak, near Incline, A. F. Rogers (39) p. 171.

LABRADORITE

Calcium, sodium, and aluminum silicate, $m CaAl_2Si_2O_8$ with $n NaAlSi_3O_8$, nearer anorthite in composition

Triclinic. Small twinned grains in rocks; sometimes massive with twinning striations. Properties like oligoclase. H. = 5-6. G. = 2.69-2.71.

Same reactions as for oligoclase. Slightly acted on by hydrochloric acid.

Labradorite is an essential constituent of most basic igneous rocks such as gabbros, diabases, and basalts. It also occurs in veins.

Los Angeles County: **1**, Labradorite forms the principal part of anorthosite masses in the western San Gabriel Mountains (T. 4 N., R. 14 W., S. B.), Tucker and Sampson (4) pp. 417, 418, W. J. Miller (7) pp. 15-17, Higgs (1), p. 177.

Modoc County: **1**, Labradorite with inclusions of metallic copper has been found in this county, Andersen (1) p. 91.

MICROCLINE

Potassium and aluminum silicate, $KAlSi_3O_8$

Triclinic. Crystals very common. Bases often show rectangular grating structure. Massive or compact. Cleavage like orthoclase. Brittle. Vitreous, sometimes pearly. Color white to pale cream yellow, red, green. H. = 6-6½. G. = 2.54-2.57.

Same reactions as for orthoclase.

Amazonite or *amazon stone* is a green microcline, and is used as a semi-precious gem.

Microcline has the same composition as orthoclase, but differs from it in its twinning structure and crystallization. It is a constituent of some granites and pegmatites. Much of the white feldspar of pegmatites is microcline rather than orthoclase.

Inyo County: **1**, Abundant green microcline in poorly developed crystals, is found in pegmatite 1½ miles east of Lone Pine Station, Murdoch p. c., '45). This may be the locality noted by Ward in Sterrett (10) p. 321. **2**, It has been reported 6 miles west of Lone Pine, W. W. Bradley (29) p. 311.

Riverside County: **1**, Graphic granite of the Southern Pacific silica quarry at Nuevo, is quartz and microline, Wahlstrom (1) p. 694.

Tuolumne County: **1**, Phenocrysts of microcline up to 2 inches in length occur in granite porphyry at Tuolumne Meadows, Calkins (4) p. 127.

OLIGOCLASE

Sodium, calcium, and aluminum silicate. $m NaAlSi_3O_8$ with $n CaAl_2Si_2O_8$, nearer albite in composition

Triclinic. Crystals usually twinned like albite. Commonly massive or compact. Two perfect cleavages. Brittle. Colorless to white. Streak uncolored. H. = 6-6½. G. = 2.63-2.65.

Same reactions as albite. The calcium can be determined in the wet way, by precipitation as calcium oxalate. All insoluble silicates need to be fused with sodium carbonate to render them soluble.

Oligoclase is a constituent of granodiorites, diorites, porphyrites, and andesites. It is occasionally found in large white masses as veins in diorite and other basic rocks.

Tulare County: **1**, Large well-formed crystals of oligoclase occur with quartz and black tourmaline in a pegmatite at Salt Creek, A. F. Rogers (32) p. 116.

ORTHOCLASE

Potassium and aluminum silicate, $KAlSi_3O_8$

Monoclinic. Crystals prismatic, very common; often as Carlsbad twins. Massive or compact. Two perfect cleavages. Brittle. Vitreous luster. Colorless, white, pale yellow, flesh red. Streak uncolored. H. = 6. G. = 2.54-2.57.

Fuses at 5 in the scale of fusibility, therefore can only be rounded on edges of splinter. Insoluble in acids. The powder mixed with gypsum, taken on the loop of a platinum wire and held in the colorless flame of a Bunsen burner, will give the violet flame of potassium, best seen through blue glass or the Merwin color screen.

Adularia is a glassy, transparent variety, sometimes found in large crystals.

Moonstone is a variety of adularia.

Sanidine, a *glassy feldspar*, frequently occurs as crystals in rhyolite.

Valencianite is a variety name given to vein orthoclase.

Perthite is an intergrowth of orthoclase or microcline and albite. It is an important constituent of some granites and pegmatites.

Orthoclase is an essential constituent of many igneous rocks, granites, syenites, quartz porphyries, rhyolites, and trachytes. Large crystals often form the phenocrysts of porphyritic rocks, and these crystals are often Carlsbad twins. The color of granites is mainly due to the color of the orthoclase, red granites having orthoclase colored by ferric oxide. Granites, syenites, and diorites are often intersected by pegmatite veins consisting of coarse crystals and massive orthoclase (or microcline) with quartz and mica, and these veins vary greatly in width; some can be quarried for the feldspar.

Calaveras County: **1**, Valencianite occurs 5 miles east of Milton on the road to Copperopolis, A. F. Rogers (7) p. 376.

El Dorado County: **1**, Colorless crystals of adularia are found on the south side of Fallen Leaf Lake, A. F. Rogers (7) p. 376.

Inyo County: **1**, Adularia, variety moonstone, occurs as very small crystals in rhyolite near Rialto, in the Funeral Mountains, Kunz (23) p. 950, (24) p. 79. **2**, Distinct crystals of sanidine are common in the Bishop tuff, Gilbert (1) p. 1834.

Kern County: **1**, Large phenocrysts of orthoclase, usually as Carlsbad twins, occur in a dike-like mass of granite porphyry 4 miles north of Cinco by the aqueduct road, Murdoch and Webb (14) p. 325.

Madera County: **1**, Large Carlsbad twins of orthoclase occur in granite porphyry at Reds Meadows, Goudey (1) p. 8.

Monterey County: **1**, Orthoclase phenocrysts up to 10 centimeters in size occur in the Santa Lucia granite in the Carmelo Bay area, Lawson (1) p. 10. **2**, Orthoclase showing spectroscopic traces of germanium has come from Pacific Grove, Papish (2) p. 474. **3**, A large mass of pure creamy to white orthoclase has been quarried 4 miles east of Chualar (sec. 34, T. 15 S., R. 5 E., M. D.), W. W. Bradley and Waring (6) p. 601.

San Bernardino County: **1**, Orthoclase phenocrysts up to 7 inches in length are abundant, usually as Carlsbad twins, in monzonitic porphyry 1½ miles southwest of Twentynine Palms, W. J. Miller (8) p. 428. **2**, Flesh-colored orthoclase phenocrysts as long as 2 inches occur 1 mile north of the Pines (sec. 5, T. 1 N., R. 1 E., S. B.), Baker (1) p. 338.

FERBERITE

See wolframite

FERGUSONITE

An oxide of titanium and the rare earths, $(Y,Er)_8(Cb,Ta,Ti)_8O_{32}$

Columbium and tantalum vary widely in proportions. Tetragonal. Crystals prismatic to pyramidal. H. = 5½-6½. G. = 5.6-5.8. Luster externally dull; on fracture brilliantly vitreous and submetallic. External color gray, yellow, brown; on fracture surfaces brownish black, velvety black. Streak brown.

Riverside County: **1**, 1½-inch crystals were reported to have come from Box Spring Mountain, Foshag (p.c., '46).

FERRIMOLYBDITE—Molybdite

Hydrous iron molybdate, $Fe_2O_3{\cdot}3MoO_3{\cdot}8H_2O$

Orthorhombic. Fibrous crystals in radiating tufts; earthy. One cleavage distinct. Color sulphur yellow. H. = 1½. G. = 4.5.

A deep-blue solution is obtained by dissolving the powder in concentrated sulphuric acid with a scrap of paper not larger than a pinhead. The solution soon turns brown.

El Dorado County: **1**, A specimen in the University of California collections at Berkeley, No. 278, is from the Cosumnes mine near Fairplay.

Del Norte County: **1**, It has been reported at French Hill, with bornite (N.R.).

Fresno County: **1**, It has been found near Palisade Creek, with molybdenite, W. W. Bradley (24) p. 345, S.M.B. (20311).

Kern County: **1**, Sulphur-yellow, fibrous crystals of ferrimolybdite have been found in Jawbone Canyon (secs. 10, 11, 14, 15, T. 30 S., R. 36 E., M. D.), W. W. Bradley (29) p. 107.

Madera County: **1**, It occurs with molybdenite on Red Mountain in the Ritter Range, Erwin (1) p. 71, Goudey (1) p. 8.

Mariposa County: **1**, Reported with molybdenite from the Kinsley mining district, 7 miles from El Portal (N.R.).

Mono County: **1**, It occurs in white quartz with molybdenite, 12 miles northwest of Bridgeport, Pratt (4) p. 265. **2**, On Silverado Creek (T. 7 N., R. 25 E., M. D.), Whiting (1) p. 363. **3**, Beautifully crystallized ferrimolybdite from the Tiger claim, Patterson district, is represented by a specimen in the University of California collection at Berkeley.

Nevada County: **1**, Occurs mixed with limonite, at the Wisconsin and Illinois claim near Nevada City, Owen (1) p. 108, Genth (3) p. 248. **2**, Found with molybdenite and gold at the Excelsior mine, Hanks (12) p. 274.

San Bernardino County: **1**, It was found near State Line (T. 17 N., R. 16 E., S. B., approx.), S.M.B. (16107).

San Diego County: **1**, Found with feldspar near Ramona (sec. 11, T. 13 S., R. 1 W., S. B.), Calkins (1) p. 75

Shasta County: **1**, Found with ilsemannite and molybdenite, 4 miles west of Gibson (sec 33, T. 37 N., R. 5 W., M. D.), Cook (1) p. 50. **2**, From Hazel Creek, S.M.B. (18569).

Sierra County: **1**, It is found in copper ore at the Sierra Buttes mine near Hurd's Ranch, J. R. Browne (4) p. 210, Burkart (2) p. 21.

Trinity County: **1**, It occurs with molybdenite near Lewiston, S.M.B. (19433).

Tuolumne County: **1**, A specimen with minute canary-yellow needles, in the University of California collection at Berkeley, is from the Stuart ledge, Larsen (11) p. 112.

Yuba County: **1**, Reported with molybdenite near Camptonville (N.R.).

FERROPALLIDITE

See szomolnokite

FIBROFERRITE

Hydrous iron sulphate, $Fe_2O_3(SO_3)_2 \cdot 10H_2O$

Orthorhombic. Fine fibrous aggregates. Silky luster. Color pale yellow to white. H. = 2-2½. G. = 1.9.

Fusible. Becomes magnetic on heating. Soluble in water.

Napa County: **1**, Fibroferrite has been found with cinnabar, opal, sulphur, and sulphates in the Redington mine at Knoxville, A. F. Rogers (35) p. 397.

San Bernardino County: **1**, Fibroferrite occurs with krausite, coquimbite, and other sulphates in the Calico Hills near Borate, 6 miles northeast of Yermo, Foshag (19) p. 352.

Trinity County: **1**, Fibrous aggregates of yellow fibroferrite occur in the pyrrhotite deposit at Island Mountain, Landon (1) p. 279, Melhase (3) No. 6, p. 2.

FIBROLITE

See sillimanite

FIREBLENDE

See pyrostilpnite

FIRE OPAL

See opal

FLINT

See quartz, chalcedony

FLOS-FERRI

See aragonite

FLUORITE

Calcium fluoride, CaF_2

Isometric. Usually in cubes; also massive, granular, or compact. Cleavage perfect octahedral. Brittle. Vitreous luster. Green, purple, blue, white, yellow, colorless. Streak white. H. = 4. G. = 3.01-3.25.

Fuses with some decrepitation. Gives reddish flame of calcium. Soluble in acids and calcium is precipitated by ammonium oxalate. Mixed with potassium sulphate and fused in a closed tube, it etches the glass.

Fluorite is a common mineral, especially as gangue in lead deposits with galena. It sometimes forms thick veins.

Contra Costa County: **1**, Small cubes of white fluorite were found on Mount Diablo with some copper minerals, Hanks (12) p. 181, Kunz (24) p. 102.

Inyo County: **1**, Fluorite is found as a gangue mineral with argentiferous galena in the Cerro Gordo, Darwin, and other districts, A. Knopf (4) p. 7, C. A. Waring and Huguenin (2) p. 95, Kelley (4) p. 543, A. L. Ransome and Kellog (1) p. 483. **2**, Purple veinlets of fluorite in marble are reported to carry gold values, at the Waterfall prospect, 3 miles north of Antelope Springs, Deep Springs Valley, A. Knopf (5) p. 113. **3**, An extensive deposit is reported on Tin Mountain, Ubehebe Mining District, Anon. (5). **4**, Fluorite is reported from Warm Springs, T. 22 N., R. 1 E., S.B., Crosby and Hoffman (1) p. 631, as small purple veins.

Kern County: **1**, Fluorite veins occur in the west end of the Rand Mountains near Randsburg (N.R.). **2**, Fluorite is found in sec. 12, T. 29 S., R. 38 E., M.D., in Last Chance Canyon, Crosby and Hoffman (1) p. 632.

Lake County: **1**, Massive green fluorite comes from a locality 4 miles southeast of Kelseyville, W. W. Bradley (29) p. 222.

Los Angeles County: **1**, Fine specimens of fluorite consisting of purple and green masses and cubes have come from the Felix mine north of Azusa, Murdoch (p. c. '45). **2**, White fluorite occurred on Santa Catalina Island with galena and chalcopyrite (N. R.). **3**, Half-inch cubes of fluorite are found in cavities of a fault breccia at locality 20, west side of Higgins Canyon, Neuerburg (1) p. 159.

Mono County: **1**, Green and violet crystals and masses of fluorite occur in Ferris Canyon on the eastern slope of the Sweetwater Mountains, Kunz (24) p. 102. **2**, Fluorite occurs with andalusite in the mine of Champion Sillimanite, Incorporated, on the western slope of the White Mountains, 7 miles east of Mocalno, Jeffery and Woodhouse (3) p. 461.

Riverside County: **1**, Transparent crystals of fluorite were marketed for optical purposes in 1917-18, from the Floyd Brown mine, near Blythe, Aubury (1) p. 258. An additional reference, gives location of Fluorspar group as sec. 4, T. 10 S., R. 18 E., S.B., Crosby and Hoffman (1) p. 632. A small tonnage was also shipped for industrial use. **2**, Large veins of fluorite are reported in quartzite (sec. 27, T. 3 S., R. 20 E., S. B.), Tucker and Sampson (35) p. 164. **3**, Fluorite is reported from the tin ore at Cajaleo, West (3) p. 132.

San Bernardino County: **1**, Green and purple fluorite with some iceland spar comes from the Kings fluorspar mine, Cave Canyon district, Tucker and Sampson (16) p. 301, Burchard (1) p. 373, Hewett et al. (1) p. 171. **2**, Light-green fluorite occurs near Barstow (N. R.). **3**, Fluorite is also found near Ludlow, S. M. B. (18952), and **4**, near Needles (N. R.). **5**, Colored fluorite occurs in a vein on the McDermott deposit, 4 miles east of Nipton, Tucker and Sampson (16) p. 302. **6**, Numerous small veins of green and white fluorite occur near Baxter Station, near Soda Lake, T. 17 N., R. 13 E., S.B., ibid. p. 302. Crosby and Hoffman (1) p. 625. **7**, Lenses of fluorite up to 2 feet in length are found in the Philadelphia fluorspar deposit in the Providence Mountains, 25 miles south of Cima (sec. 4, 5, 7, T. 10 N., R. 6 E., S.B.), Crosby and Hoffman (1) p. 633, Tucker (4) p. 343. **8**, Veins of fluorite, with sulphides, are found at the Live Oak mine, T. 14 N., R. 16 E., S.B., Crosby and Hoffman (1) p. 636. **9**, At the Green Hornet mine, sec 7, 8, T. 6 N., R. 1 W., S.B., fluorite occurs in veins with quartz, Crosby and Hoffman (1) p. 636. **10**, Dark purple fluorite is found in Ivanpah Mountain, sec. 8, T. 14 N., R. 14 E., S.B., Crosby and Hoffman (1) p. 636.

San Diego County: **1**, A small amount of fluorite is found at the Mountain Lily gem mine, Aguanga Mountain, F. J. H. Merrill (1) p. 705.

Santa Clara County: **1**, White crystals of fluorite were found near the Almaden mine, Hart (1) p. 138, Irelan (4) p. 46.

Tulare County: **1**, A deposit of massive fluorite occurs 18 miles east of Springville, sec. 34, T. 20 S., R. 31 E., M.D., Franke (1) p. 439.

Yolo County: **1**, A fluorite deposit is reported from an unspecified locality in the county, Mining and Scientific Press (18) p. 370.

FORSTERITE

Magnesium silicate, Mg_2SiO_4

See also olivine and fayalite

Orthorhombic. Small equidimensional or tabular crystals or grains. H. = 6-7. G. = 3.2-3.3. Color white, greenish, or yellow.

Riverside County: **1**, Forsterite occurs with hydrotroilite in the new city quarry, Victoria Avenue, Riverside, W. W. Bradley (29) p. 456. **2**, Forsterite has been identified in the contact rocks of the Crestmore quarry, Burnham (p.c. '54).

San Bernardino County: **1**, Forsterite has been found on the northwest slope of Ontario Peak, at Cascade Canyon (SW¼ sec. 31, T. 2 N., R. 7 W., S. B.), W. W. Bradley (29) p. 456.

FOSHAGITE, 1925

Hydrous calcium silicate, $H_2Ca_5Si_3O_{12} \cdot H_2O$?

Orthorhombic. Parallel fibrous. White. H. = 3. G. = 2.67. F. = 7. Gelatinized in HCl.

Riverside County: 1, Described from Crestmore by Eakle (23) p. 97. Fibrous masses and slip-veins in vesuvianite and monticellite rocks. Woodford (11) p. 357. Believed to be a variety of hillebrandite, Vigfussen (1) p. 76. Flint, McMurdie and Wells (1), p. 617, and Winchell (2) give it separate status.

FRANCOLITE

See apatite

FRANKEITE

Sulfide of lead, tin, and antimony, $Pb_5Sn_3Sb_2S_{14}$

Orthorhombic. Crystals thin tabular, elongated. One perfect cleavage. Flexible but not elastic. H. = 2½-3. G. = 5.9. Luster metallic, color and streak black.

Soluble in HNO_3 with separation of oxides of tin and antimony.

Santa Cruz County: 1, This rare mineral occurs with meneghinite and stannite in the limestone contact rock of the Pacific Limestone Products quarry, 2 miles west of Santa Cruz, Chesterman (p.c. '54).

FREIBURGITE

See tetrahedrite

FUCHSITE

See muscovite

GAHNITE

See spinel

GALENA

Lead sulphide, PbS

Isometric. Cubes and cubo-octahedrons common; also massive, coarse or fine granular. Cleavage perfect cubic. Metallic luster. Color and streak lead gray. H. = 2½. G. = 7.4-7.6.

Heated on charcoal, a dense lemon-yellow coating forms and a slight odor of sulphur can be detected. Easily reduced to a bead of metallic lead.

Cuproplumbite is identical with galena.

Galena is a very common mineral, and occurs in greater or less amounts in nearly every ore deposit in the state. It is prominent in many of the mining districts, and occurs in considerable amounts in some of them. Much of it is accompanied by silver minerals, and such combinations form important sources of silver. It is present, usually in minor amount, with chalcopyrite or sphalerite in gold-quartz veins. Its common alteration products, cerussite and anglesite, frequently accompany it. Only the more important or interesting occurrences can be noted in detail, but some references to those of lesser consequence will be listed under the counties. Hanks (12) p. 181 gives a rather extensive list of occurrences as known at that date.

Alameda County: 1, Lumps of coarse crystalline galena, from an unknown source, weighing up to 100 pounds, have been found at Euclid Avenue and Codornices Creek in Berkeley, Lawson (7) p. 23.

Alpine County: 1, Argentiferous galena is common in the Loope area near Markleeville. Crawford (1) p. 373; Eakle (16) p. 11; Logan (4) p. 402; W. W. Bradley (15) p. 488; Gianella (1) p. 342.

Amador County: 1, Galena is widespread in small amounts in the mines near Plymouth and along the Mother Lode, Josephson (1) p. 475.

Butte County: **1,** It is recorded at Butte Creek and other districts, C. A. Waring (4) p. 214.

Calaveras County: **1,** It is one of the universal minor vein minerals in the Mother Lode mines; Reid (3) p. 397, Moss (1) p. 1011.

El Dorado County: **1,** It is present in many of the mines of the county, Logan (9) p. 406.

Fresno County: **1,** Galena occurs in gold ores at a number of mines, Goldstone (1) p. 197.

Imperial County: **1,** Small amounts occur in the Picacho and other areas, F. J. H. Merrill (1) p. 732, Tucker (11) p. 262, R. J. Sampson and Tucker (18) p. 128, Henshaw (1) p. 185.

Inyo County: Argentiferous galena has formed the important silver ore in the county. Extensive deposits occur in the Darwin, Cerro Gordo, Panamint, Ubehebe and other districts: **1,** Cerro Gordo, A. Knopf (8) p. 114; **2,** Darwin, Crawford (1) p. 24, A. Knopf (4) p. 7, Kelley (4) p. 543; **3,** Panamint, fine crystals from the Blue Wing mine, S. M. B. (7616), Crawford (1) p. 373, Murphy (2) pp. 313, 321, Tucker (11) p. 488. Other lesser deposits in the county are referred to in the following: **4,** Mining and Scientific Press (1) p. 3; **5,** De Groot (2) p. 213; **6,** Crawford (2) p. 32; **7,** C. A. Waring and Huguenin (2) pp. 76, 84, 100, 101, 105; **8,** Tucker (4) pp. 284, 286, 291; **9,** Tucker (8) p. 33; **10,** Tucker (11) pp. 473, 489, 495, 507; **11,** R. J. Sampson (7) p. 369; **12,** R. J. Sampson (11) p. 266; **13,** Tucker and Sampson (25) pp. 383, 397, 413, 427, 429; **14,** Tucker and Sampson (27) p. 26; **15,** Tucker and Sampson (32) p. 59.

Kern County: **1,** Small amounts of galena are found in the Mojave, Cove and other districts. Tucker and Sampson (21) p. 290; Simpson (1) p. 409; Prout (1) p. 413.

Los Angeles County: **1,** Galena was recorded from this county at a very early date. In 1792 Martinez (1) p. 42 reported galena (?) from Santa Catalina Island. A "silver mine" was known here as early as 1847, Sloat (1) p. 366. Later references to this locality are in Mining and Scientific Press (5) p. 263, Preston (2) p. 280, Gieser (1) p. 245. **2,** Duflot de Mofras (1) p. 186, noted "silver ore," presumably argentiferous galena, at Rancho Cahuenga, 2 leagues north of Los Angeles. **3,** Galena occurs with fluorite at the Felix fluorite mine, Azusa, Murdoch (p. c., '45). Other references: Preston (2) p. 204, Storms (4) p. 244, Tucker (4) p. 318 (8) p. 42, (13) p. 317.

Madera County: **1,** Large cubes of galena have come from the Star mine, Mount Raymond district (N. R.). **2,** It occurs in minor amounts in the Minaret district, W. W. Bradley (9) p. 548, Erwin (1) pp. 66, 67.

Mariposa County: **1,** Minor amounts occur in some of the gold-quartz veins, J. B. Trask (7) p. 52; J. D. Whitney (7) p. 238; Mining and Scientific Press (26) p. 24; Preston (2) p. 303.

Mono County: **1,** Argentiferous galena forms important bodies of ore in the Bodie and Benton districts. **2,** It is also present in the Lundy and Sweetwater areas. Eakle and McLaughlin (17) pp. 141, 172; A. L. Ransome (2) p. 171.

Monterey County: **1,** One of the early mines in the state, at the Alisal ranch, reported as early as 1802, carries galena. Duflot de Mofras (1) p. 215; A. Robinson (1) p. 152; W. P. Blake (7) p. 295; W. W. Jenkins (1) p. 70.

Napa County: **1**, Galena is one of the minor minerals at the Palisades mine, 2 miles north of Calistoga, Hulin (p. c., '36).

Nevada County: **1**, Galena is one of the minor vein minerals in the gold ores of the county, W. P. Blake (9) p. 13, Hobson (1) pp. 384, 392-394, Lindgren (12) p. 118, Wisker (1) p. 194.

Orange County: **1**, "Leafy galena in narrow bands and solid bunches" occurs at the Alma mine (T. 5 S., R. 6 W., S. B.), Santiago Canyon, Fairbanks (4) pp. 115, 117, L. L. Root (3) p. 63.

Placer County: **1**, Galena is found in minor amounts in most of the gold mines of the county, Silliman (7) p. 351; Lindgren (7) p. 272; C. A. Waring (4) p. 331; Logan (4) p. 445, (17) pp. 16-39.

Riverside County: **1**, It was one of the minerals at the limestone quarry at Crestmore, Eakle (15) p. 352. **2**, It occurs in various other localities in the county, Goodyear (3) p. 527; Irelan (5) p. 904; F. J. H. Merrill (2) pp. 532-541; Tucker (8) p. 195; R. J. Sampson (9) p. 514.

Sacramento County: **1**, It occurred with sphalerite and pyrite at Michigan Bar, Hanks (12) p. 181.

San Bernardino County: Galena, with its oxidation product cerussite, is widespread in relatively small amounts, in the silver and gold mines of the county. References follow: Crossman (1) p. 217 (Old Woman Mountains), p. 231 (Lava Beds), p. 263 (Morongo); Storms (4) p. 366 (Silver Reef); Crawford (1) p. 25 (Silver Mountains); Cloudman et al. (1) p. 790 (New York Mountains), p. 805 (Goldstone) p. 821 (Ibex mine); Tucker (4) p. 340 (Kelso), p. 345 (Twenty-nine Palms), p. 359 (Shadow Mountain), (7) p. 95 (Clark Mountain); Erwin and Gardner (3) p. 245 (Lead Mountain), p. 320 (Calico); Hulin (1) p. 83 (California Rand mine); Tucker and Sampson (17) p. 298 (Dale), (27) p. 61 (Dale), (32) p. 69 (Mohawk mine).

San Diego County: **1**, A small deposit of galena occurs $2\frac{1}{2}$ miles north of Valley Center (NW$\frac{1}{4}$ sec. 1, T. 11 S., R. 2 W., S. B.), Tucker (10) p. 350; also **2**, in the Laguna Mountains, and **3**, Deer Park district, ibid. **4**, Galena is found at the Descanso mine (sec. 24, T. 15 S., R. 3 E., S. B.), Tucker (8) p. 371.

San Mateo County: **1**, A 30-inch vein is reported half a mile south of Searsville Lake, Huguenin and Castello (4) p. 172.

Shasta County: **1**, Galena is abundantly present in the Woodrow Wilson mine (sec. 4, T. 33 N., R. 2 W., M. D.), Tucker (9) p. 447. Other deposits are listed by Logan (9) pp. 176-193, and Averill (4) pp. 7, 57.

Sierra County: **1**, Ferguson (2) p. 165 describes an interesting occurrence of galena in the Alleghany district: ". . . frequently a small nucleus of solid cleavable galena, up to 2-3 mm., and radiating from it, delicate needles not over 2 mm., similar to rutile, so closely spaced as to give the effect of chestnut burrs." 2, Masses of galena occur in a limestone cave near Downieville, Mining and Scientific Press (20) p. 23. It occurs in small amounts in most of the mines in the county.

Siskiyou County: **1**, Galena is found at a number of localities, nowhere in great amount: Logan (7) p. 181; Averill (3) p. 60, (5) pp. 280, 298.

Tehama County: **1**, Galena occurs on Cow Creek, Hanks (12) p. 181.

Trinity County: **1**, Galena occurs widespread in the mines in the slate area of the county, Ferguson (1) p. 44. Other references: W. P. Miller (1) p. 713; Logan (9) p. 16; Averill (10) pp. 28, 34, 36, 42, 64.

Tulare County: **1**, It occurs in minor amount in the mines of the Mineral King district, Goodyear (3) p. 646, Tucker (3) pp. 947-954, Franke (1) p. 436.

Tuolumne County: **1**, Galena was reported at the Marble Springs mine by W. P. Blake (7) p. 295, and occurs at many other mines in the county, W. P. Blake (9) p. 13; Tucker (1) p. 138.

Ventura County: **1**, Galena has come from the Piru district, S.M.B. (384).

GANOPHYLLITE

Hydrous manganese and aluminum silicate, $7MnO \cdot Al_2O_3 \cdot 8SiO_2 \cdot 6H_2O$

Monoclinic. Tabular crystals. Perfect basal cleavage. Vitreous luster. Color yellowish to brown. H. = 4-4½. G. = 2.84.

Easily fusible. Gives green bead of manganese with sodium carbonate. Soluble in strong acid.

Santa Clara County: **1**, Ganophyllite was one of the minerals of the manganese boulder found near Alum Rock Park, 5 miles east of San Jose. It occurred in seams with barite, as brownish-yellow tabular crystals, A. F. Rogers (21) p. 446.

GARNET GROUP

Isometric. Rhombic dodecahedrons and trapezohedrons common. Also compact to granular massive. Vitreous luster. Color generally some shade of red; also yellow, brown, green, black, and white. Streak white. H. = 6½-7½. G. = 3.15-4.3.

Most garnets are fusible at about 3 to a brownish glass, but are insoluble. The iron garnets, almandite and andradite, become magnetic when fused and are slightly soluble, yielding a small amount of gelatinous silica. Uvarovite is infusible, but yields a chromium bead with borax, spessartite yields a manganese bead with borax. The bases of most garnets can best be determined by wet methods, that is: precipitation of each from solution by reagents.

Grossularite, Essonite, Hyacinth. Calcium-aluminum garnet, $Ca_3Al_2Si_3O_{12}$. It is common as a contact mineral in crystalline limestone. It is generally a light shade of red or green, sometimes almost white, and when clear forms a valued gem. G. = 3.53.

Pyrope. Magnesium-aluminum garnet, $Mg_3Al_2Si_3O_{12}$. It occurs usually in serpentine and peridotite. Deep blood-red color. G. = 3.51.

Almandite. Iron-aluminum garnet, $Fe_3Al_2Si_3O_{12}$. It is a common garnet of gneisses and schists. Color brownish red; sometimes of gem value. G. = 4.25.

Andradite. Calcium-iron garnet, $Ca_3Fe_2Si_3O_{12}$. It is a common garnet of gneisses and schists. It is rarely clear enough for gems. Color yellow, green, brown, to black. *Topazolite* is a calcium-iron garnet having the color and transparency of topaz. *Aplome* is a manganiferous variety of andradite. G. = 3.75.

Spessartite. Manganese-aluminum garnet, $Mn_3Al_2Si_3O_{12}$. It occurs usually in pegmatite veins. Dark-red color. G. = 4.18.

Uvarovite. Calcium-chromium garnet, $Ca_3Cr_2Si_3O_{12}$. It is generally found as crystals coating massive chromite. Color emerald green. G. = 3.41-3.52.

Garnet is one of the common minerals of the state and probably all of the known varieties occur here. Garnet is generally a product of metamorphism and is common in metamorphic rocks such as gneiss, schist, quartzite, and crystalline limestone. As a contact mineral formed by the instrusion of igneous rock into limestone and other rock, it is often found in fine large crystals. Many pegmatites carry garnet crystals, sometimes of excellent form and quality. It is a common constituent of beach sands and of the concentrates of mining districts.

Alpine County: **1**, The old Uncle Billy Rogers copper claim in Hope Valley was located in garnet rock. W. P. Blake (9) p. 13 reported fine green grossularite from this valley; see also Hanks (12) p. 182, 225. **2**, Uvarovite in small crystals has been reported from the Calaveras mine, Trainer (p. c., '46).

Butte County: **1**, Red and brown garnets were common in the sands of the gold washings at Cherokee, Silliman (13) p. 385.

Calaveras County: **1**, Good crystals of andradite occur in schist at the Shenandoah mine, Woodhouse (p. c., '45). **2**, Andradite is found with idocrase and epidote at Garnet Hill, just above the confluence of Moore Creek and the Mokelumne River, Turner (12) p. 706, Melhase (6) p. 7. **3**, Uvarovite is reported from an unidentified location in the county, Jarvis (p. c., '46). Numerous seams of uvarovite in chromite are reported from SW¼ sec. 9, T. 1 N., R. 13 E., M.D., Cater (2) p. 50. This may be a confirmation of locality reported by Jarvis. **4**, Almandite is found at Bald Point, Mokelumne River, Kunz (24) p. 51.

Del Norte County: **1**, Uvarovite occurs with kämmererite on chromite at the Brown mine (sec. 28, T. 18 N., R. 2 E., H.), Vonsen (p. c., '45). **2**, Camp 8 (sec. 19, T. 16 N., R. 3 E., H.) J. E. Allen (2) p. 123.

El Dorado County: **1**, Large crystals of grossularite have been found at the old Cosumnes copper mine (N. R.). **2**, Good crystals of garnet occurred 9 miles southeast of Placerville, S. M. B. (13937). **3**, At the Lilyama mine, Pilot Hill, crystals of garnet occurred with chalcopyrite, galena, calcite, and quartz (N. R.). **4**, Garnet occurs with quartz and epidote at Grass Lake, near Glen Alpine, Clark (p. c., '35). **5**, Garnet occurred at the Fairmount mine, 3 miles from Pilot Hill in large blocks and masses 2 or more feet thick, Hanks (12) p. 181, Kunz (24) p. 52. **6**, Pure white grossularite with idocrase has been described by Pabst (2) p. 2 from veins in serpentine along Traverse Creek about 2½ miles south-southeast of Georgetown. Some clear perfect crystals were found there. **7**, Uvarovite occurs at the Pilliken mine (secs. 21, 22, T. 11 N., R. 8 E., M. D.), Averill (11) p. 90. **8**, At the Placer chrome mine, 6 miles south of Newcastle, Shannon (3) p. 376.

Fresno County: **1**, Brown garnet is associated with green tourmaline on Spanish Peak in a ledge of white quartz, W. W. Bradley (2) p. 439. **2**, It was found in crystals near Dunlap, Irelan (3) p. 208. **3**, White opaque garnet occurs in calcite with green californite at San Ramon on the south side of Watts Valley, Kunz (24) p. 52, W. W. Bradley (2) p. 439. **4**, White garnet occurring with californite 35 miles east of Selma has been analyzed by Steiger, Clarke and Steiger (8) p. 72. **5**, Large crystals occur "frozen," in the matrix on Squaw Creek, Melhase (6) p. 22.

Imperial County: **1**, Opaque white grossularite is found with wollastonite near the highway a few miles west of El Centro, Melhase (6) p. 23.

Inyo County: **1**, Large semi-crystalline masses of light-yellow garnet are found in the Coso district, Hanks (12) p. 182, Kunz (24) p. 52. **2**, Fine large crystals of grossularite occurred with massive white datolite and greenish-brown idocrase at the San Carlos mine, north of Mazourka Canyon, on the west slope of the Inyo Range, John L. Smith (1) p. 435. **3**, Garnet is one of the principal gangue minerals at the scheelite deposits about 7 miles west of Bishop, A. Knopf (6) p. 233, Lemmon (5) p. 504. **4**, An outcrop of dark-red rock, mostly garnet,

with some crystals up to half an inch in size, occurs at New York Butte, near its summit, Goodyear (3) p. 256. **5**, Light-green grossularite-andradite occurs in abundant large crystals (one nearly a foot across) in the contact zone at Darwin, A. Knopf (4) p. 7, Kelley (4) p. 538.

Kern County: **1**, Large crystals of almandite occur in diorite on a branch of Tunis Creek, about half a mile southwest of the Tejon ranch headquarters, Melhase (6) p. 8, Schürmann (2) p. 225, Murdoch (8) p. 189. **2**, Almandite in well-formed crystals up to 4 centimeters across occur in biotite-chlorite schist in a road cut of the Angeles Crest highway near Georges Gap, Murdoch and Webb (6) p. 351. **3**, Fine crystals of green andradite occur in skarn on Erskine Creek, sec 9, T. 27 S., R. 33 E., M.D., Chesterman (p.c. '51).

Madera County: **1**, Fair crystals of almandite have been found on the divide 1 mile east of Island Pass, Goudey (1) p. 7. **2**, Grossularite is abundant in limestone on Shadow and Johnston Creeks, and garnet rock occurs at Garnet Lake, Erwin (1) p. 67, Melhase (6) p. 8. **3**, Spessartite (?) has been found in small orange crystals in cavities near Shadow Lake, A. M. Short (1) p. 493.

Marin County: **1**, Almandite crystals are common in the schists of the Tiburon Peninsula, Kunz (24) p. 52, F. L. Ransome (3) p. 311.

Mendocino County: **1**, Uvarovite occurs coating chromite about 12 miles north of Willits, Melhase (6) p. 23.

Monterey County: Trautwinite, which was described as a new mineral by Goldsmith (1) p. 348, (2) p. 365, (5) p. 152, from this county, appears from the analysis to be a mixture of uvarovite and chromite, E. S. Dana (5) p. 447. **1**, Uvarovite is reported west of King City (probably Los Burros district), with chromite and kämmererite, W. W. Bradley (28) p. 497. **2**, Garnet is abundant in the beach sand at the mouth of the Sur River, P. D. Trask (1) p. 165.

Nevada County: **1**, Fine green crystals of uvarovite occurred, coating the chromite at the Red Ledge mine, 2 miles southwest of Washington, (sec. 13, T. 17 N., R. 10 E., M. D.) associated with rhodochrome and kämmererite, E. M. Boyle (1) p. 77.

Orange County: **1**, Pale apple-green pebbles of grossularite were found near El Toro and analyzed by Steiger, Clarke (5) p. 76.

Placer County: **1**, Essonite is found at Deer Park, Kunz (23) p. 925. **2**, Uvarovite has been found on chromite near Towle, Lindgren (2) p. 5, Melville and Lindgren (1) p. 27. **3**, Uvarovite has been found on chromite near Auburn (N. R.). **4**, Fine uvarovite crystals have been found on chromite, 7 miles southeast of Newcastle at the Farmer Swanton mine, with rhodochrome and kämmererite, Melhase (6) p. 23. **5**, Uvarovite is found with chromite at the Placer chrome mine, 6 miles south of Newcastle, Shannon (3) p. 377.

Plumas County: **1**, Oily green grossularite occurs at the Good Hope mine, Kunz (24) p. 52.

Riverside County: **1**, An abundance of grossularite and some andradite garnet occurs in the crystalline limestone at Crestmore, associated with idocrase, diopside, and wilkeite, Eakle (15) p. 339. **2**, Essonite or hyacinth garnet occurs with tourmaline in fine crystals at Coahuila, Kunz (24) p. 52. **3**, Good crystals of garnet have been found in a pegmatite near the Southern Pacific silica quarry at Nuevo, Clark (p. c., '35). **4**, Garnet occurs in the old Riverside city quarry, Melhase (6) p. 23.

San Benito County: **1**, Fine green crystals of uvarovite were found coating chromite and rhodochrome at New Idria, Brush (1) p. 268, Hanks (12) p. 183. **2**, Topazolite has been reported near New Idria, Melhase (6) p. 22, **3**, Uvarovite has been found with kämmererite on chromite near the headwaters of San Benito River (SW$\frac{1}{4}$ sec. 21, T. 18 S., R. 12 E., M. D., Murdoch (p. c., '45). **4**, Black garnets (melanite), in well-formed small crystals are abundant in chlorite schist, locally associated with spinel, 1 mile south and west of the benitoite mine, Williams (p.c. '49).

San Bernardino County: **1**, It was found with epidote and calcite in the iron ores at Dale, Harder and Rich (4) p. 237. **2**, Showy green patches of uvarovite in rock have been found northeast of Yermo on the road to Coyote Lake, T. V. Little (p.c. '47).

San Diego County: **1**, Fine crystals of transparent essonite garnet are found in the tourmaline districts of Mesa Grande, Kunz (17) p. 745, (24) p. 53; Pala, Kunz (24) p. 128; and Rincon, A. F. Rogers (4) p. 212. They have been cut into gems under the name "hyacinth." **2**, Essonite also occurs about 10 miles east of Jacumba Hot Springs with idocrase and quartz, Kunz (24) p. 52. **3**, Garnet is found in the Julian district, ibid. p. 26. **4**, Fine-granular red garnet occurs at Rincon, Rogers (4) p. 212. **5**, Essonite or hyacinth in good crystals has come from Hercules, Surprise, Lookout, and Prophet mines at Ramona, Kunz (24) p. 52. **6**, It occurs near San Vicente, ibid. p. 52. **7**, Massive garnet occurs at the McFall mine, 7$\frac{1}{2}$ miles southeast of Ramona, F. T. H. Merrill (1) p. 705. **8**, Essonite is found near Banner (sec. 25, T. 13 S., R. 8 E., S. B.), ibid. p. 765. **9**, Garnet is found with idocrase and calcite at Boulevard (N.R.). **10**, Hyacinth garnet has come from Dos Cabezas district, Kunz (24) p. 27, Sterrett (3) p. 810. **11**, Spessartite from the Katerina mine on Heriart Hill, near Pala, was analyzed by Schaller, R. C. Wells (3) p. 101. **12**, The first record of garnet in California was made at Point Loma in 1792 by Martinez (1) p. 40. **13**, Spessartite occurs with rhodonite in the Jacumba area (sec. 16, T. 18 S., R. 8 E., S. B.), P. D. Trask et al. (4) p. 85.

Santa Clara County: **1**, Garnet from the omphacite-eclogite of Coyote Creek was analyzed by W. O. Clarke, J. P. Smith (1) p. 203. Some of the small red garnets at this locality carry free gold, Holway (1) p. 347. **2**, Red garnets up to half an inch in size occur in the eclogites of Hilton Gulch, Oak Ridge, Holway (1) p. 353.

Shasta County: **1**, Uvarovite has been found on chromite on Shotgun Creek, Kunz (24) p. 52, Melhase (6) p. 23. **2**, Red garnet occurs on Round Mountain (N.R.). **3**, Bands of garnet mixed with pyroxene occur on the McCloud River on a contact between diabase and carboniferous limestone, Prescott (2) p. 473. **4**, Yellow garnet occurs with epidote near Castella (N.R.).

Siskiyou County: **1**, Uvarovite coats chromite at the Martin McKean mine, near Callahan, Melhase (6) p. 23. **2**, Massive white to pale-green garnet occurs with californite on Indian Creek, ibid. **3**, Uvarovite occurs with chromite in Seiad Valley (T. 46, 47 N., R. 11, 12 W., M. D.), Rynearson and Smith (1) pp. 304, 306. **4**, Uvarovite with kämmererite is found in the Youngs Valley group (T. 17 N., R. 5 E., H.), J. E. Allen (2) p. 123. **5**, Uvarovite with kämmererite has been found 14 miles southeast of Yreka, Symons (4) p. 101.

Sonoma County: **1**, Large masses of garnet occur near Petaluma, W. P. Blake (9) p. 13, W. W. Bradley (1) p. 321. **2**, Almandite garnets occur abundantly with glaucophane and actinolite in schists at Camp Meeker and near Healdsburg, W. W. Bradley (1) p. 321.

Stanislaus County: **1**, Minute crystals of uvarovite, coating fractures and shear planes, are found in the Del Puerto area (T. 6 S., R. 5 E., M. D.), Hawkes et al. (2) p. 91.

Tehama County: **1**, Uvarovite is found with chromite and kämmererite on North Elder Creek (T. 25 N., R. 7 W., M. D.), Rynearson (3) p. 200.

Trinity County: **1**, Emerald-green crystals of uvarovite occur on chromite near Carrville, Kunz (24) p. 53. **2**, Andradite occurs at Peanut (N.R.). **3**, Colorless grossularite occurs with epidote, sphene, and zircon in a soda granite-porphyry in the Iron Mountain district (N.R.).

Tulare County: **1**, Essonite in good crystals occurs at Three Rivers (N.R.). **2**, Topazolite was found at the Old Soldier mine, Drum Valley, 12 miles northeast of Visalia, Kunz (24) p. 53, Melhase (6) p. 22. **3**, Aplome was found near Visalia (sec. 25, T. 17 S., R. 28 E., M. D.), Durrell (p.c., '35). **4**, It occurs with tremolite on the North Fork of Tule River, Kunz (24) p. 53. **5**, It was found in good crystals with quartz and epidote on the Kaweah River, 25 miles northeast of Exeter, Goodyear (3) p. 644. **6**, Large crystals of grossularite occur with diopside, quartz, and epidote in metamorphic rock on a hill between Drum Valley and Slickrock Canyon, Durrell (p.c., '35). **7**, Essonite is abundant in the metamorphic rocks near Three Rivers, Kunz (12) p. 1204. **8**, Massive white grossularite is found near the Fresno County line, 1½ miles from Hawkins schoolhouse, Kunz (24) p. 52.

Tuolumne County: **1**, A lens of spessartite occurs in a pegmatite 1 mile north of the town of Tuolumne. Some of the crystals are over 2 inches in diameter, Goudey (2) p. 10.

Ventura County: **1**, Garnet crystals occur in the Piru Mountains, Kunz (24) p. 54.

Yuba County: **1**, Uvarovite is found at the Red Lodge mine, Melhase (6) p. 23.

References to a number of other occurrences, not of special importance or interest, listed by counties are: *Fresno,* Kunz (24) p. 52, Tucker and Sampson (30) pp. 565, 566; *Inyo,* A. Knopf (5) p. 120; *Kern,* S.M.B. (11388), Kunz (24) p. 52; *Lassen,* S.M.B. (2328); *Los Angeles,* Hanks (12) p. 182; *Mariposa,* Kunz (24) p. 52, Laizure (6) p. 146; *Monterey,* Kunz (24) p. 52; *Nevada,* Lindgren (20) p. 75, Clark (p.c., '35), Logan (20) p. 380; *Placer,* Clark (p.c., '35); *Plumas,* Hanks (12) p. 182; *San Bernardino,* Tucker and Sampson (16) p. 307, Murdoch and Webb (11) p. 553, Tucker and Sampson (27) p. 78; *San Diego,* Kunz (24) pp. 52, 53, (26) p. 1342, Hanks (12) p. 182; *Santa Clara,* Kunz (24) p. 53, Hanks (12) p. 182; *Sonoma,* Hanks (12) p. 182; *Tulare,* Kunz (24) p. 53; Melhase (6) p. 22; *Tuolumne,* Little (1) p. 286, Goudey (p.c., '46); *Ventura,* Hanks (14) p. 68, Kunz (11) p. 911.

GARNIERITE

Hydrous magnesium and nickel silicate, $H_2(Ni,Mg)SiO_4+H_2O$

Amorphous. Clay-like masses with pod-shaped concretions. Dull luster. Color apple green to nearly white. Soft and friable. G. = 2.3-2.8.

Infusible. Gives with borax a violet bead while hot and a brown bead when cold. Soluble in hydrochloric acid with separation of silica. Gives water in a closed tube.

El Dorado County: **1,** Garnierite has been reported near Lotus, W. W. Bradley (29) p. 222.

Imperial County: **1,** It was found on the south slope of Coyote Mountain, F. J. H. Merrill (1) p. 732.

Mariposa County: **1,** Garnierite was reported from the Pine Tree mine (sec. 9, T. 4 S., R. 17 E., M. D.), W. W. Bradley (30) p. 491.

San Benito County: **1,** Garnierite has come from the Aurora mine, near New Idria, W. W. Bradley (26) p. 608. **2,** It has been tentatively reported from Clear Creek (sec. 15, T. 18 S., R. 11 E., M. D.), in a serpentine mass, K. G. Hines (p.c., '45).

GASTALDITE

See amphibole

GAY-LUSSITE

Hydrous carbonate of calcium and sodium, $CaCO_3 \cdot Na_2CO_3 \cdot 5H_2O$

Monoclinic. Crystals often elongated; also flattened wedgeshaped. Cleavage perfect prismatic. Fracture conchoidal. Very brittle. Vitreous luster. Color white, yellowish white. Streak uncolored to grayish. H. = 2-3. G. = 1.93-1.95.

Easily fusible to a white enamel with strong yellow flame. Gives alkaline reaction on tumeric paper. Easily effervesces in acids. Gives water in closed tube. Calcium shown by precipitation with ammonium oxalate.

Lake County: **1,** Gay-lussite was found with northupite and glauberite in the muds of Borax Lake, Vonsen (3) p. 22, Vonsen and Hanna (4) p. 103.

Mono County: **1,** It was reported as present at Mono Lake, I. C. Russell (1) p. 297.

San Bernardino County: **1,** It is one of the minerals at Searles Lake, Hanks (18) p. 222, H. S. Gale (13) p. 306. Crystal forms were described by Pratt (1) p. 130, Murdoch (26), p. 360. **2,** It was reported from the Owl Springs niter beds, G. E. Bailey (2) p. 102.

GEHLENITE

Calcium and aluminum silicate, $Ca_2Al_2SiO_7$

Tetragonal. In short square prisms. Massive granular. Brittle. Resinous to vitreous luster. Color gray to brown. Streak white. H. = 5½-6. G. = 2.9-3.07.

Practically infusible. Gelatinizes with hydrochloric acid.

Velardeñite is a granular variety described from Durango, Mexico.

Inyo County: **1,** A specimen of gehlenite, S. M. B. (21332), came from the Ubehebe mining district, 2 miles east of Lost Burro Spring.

Riverside County: **1,** Gehlenite occurs in granular masses intimately intergrown with merwinite, spurrite, and diopside, at the Crestmore limestone quarry, Larsen and Foshag (10) p. 144, Woodford (11) p. 358.

Tulare County: **1,** Dull-green gehlenite, the variety velardeñite, occurs in this county, Shannon (4) p. 1.

GEIKIELITE

Magnesium titanate, $MgTiO_3$

Hexagonal rhombohedral. Crystals tabular, sometimes very small. Rhombohedral cleavage. Luster adamantine, color ruby red to nearly black. Transparent red in thin sections. Streak white. H. = 5-6. G. = 3.95.

Riverside County: 1, Geikielite occurs in microscopic red grains and crystals disseminated in brucite limestone, at the Jensen quarry, Murdoch and Fahey (20) p. 1341, (23) p. 835. This is the second recorded locality for this exceedingly rare mineral. It had previously been found only in Ceylon.

GEOCRONITE

Lead antimony sulphide, $Pb_5(Sb,As)_2S_8$

Orthorhombic. Generally massive, granular, or earthy. Metallic luster. Color and streak lead gray. H. = 2.3. G. = 6.4.

Gives the same reactions as jamesonite.

Inyo County: 1, Geocronite was reported by Hanks (12) p. 182, (15) p. 110, with anglesite and argentiferous galena, from the Santa Maria and Eclipse mines, in the Inyo Mountains.

Mono County: 1, Geocronite was reported from the Garibaldi mine, Prescott district, S. M. B. (4279), with argentiferous galena and sphalerite.

GERSDORFFITE

Sulpharsenite of nickel, NiAsS

Isometric. Usually massive. Color silver white to steel gray. H. = 5.5. G. = 5.6-6.2. Decomposed by warm nitric acid, forming a green solution with the separation of sulphur.

Mariposa County: 1, Found with garnierite at the Pine Tree mine (sec. 9, T. 4 S., R. 17 E., M. D.), W. W. Bradley (30) p. 491.

GEYSERITE

See opal

GIBBSITE (BAUXITE)

Aluminum hydrate, $Al(OH)_3$

Monoclinic. Crystals tabular. Frequently massive. One perfect cleavage. Color white, grayish, greenish or reddish white. Strong argillaceous odor when breathed upon. Yields water in the closed tube.

Infusible, and gives blue color on ignition with cobalt nitrate.

The name "bauxite" was originally applied to a supposed species with the composition $Al_2O_32H_2O$ found at Les Baux, France. The original analysis was made on a mixture of minerals in a rock mass, and approached only by chance the ratio cited. Actually, $Al_2O_3.2H_2O$ has not been found either as a natural or as an artificial product, Palache et al. (10) p. 667.

Bauxite closely resembles clay and is distinguished at sight from clay only by its characteristic pea-shaped or pisolitic structure.

Kern County: 1, Pale to deep-pink gibbsite was found in boulders of brecciated gray chert on the alluvial fans at the southern tip of the San Joaquin Valley, in the Tejon Ranch, Murdoch and Webb (6) p. 352.

Nevada County: 1, It has been doubtfully reported from the Brunswick mine at Grass Valley, Mining and Scientific Press (33) p. 271.

Riverside County: **1,** Pisolitic bauxite has been reported from the clay pits at Alberhill (sec. 26, T. 4 S., R. 6 W., S. B.), Richard (1) p. 13, but according to Bramlette (p. c. '45), this is a high-alumina clay.

GILLESPITE

Iron and barium silicate, $BaFe,Si_4O_{10}$

Tetragonal. Basal cleavage. Color red. H. = 3. G. = 3.4.
Fuses very easily. Decomposed by hydrochloric acid.

Mariposa County: **1,** It was found with sanbornite and celsian in a vein in quartzite 1 mile north of Trumbull Peak, near Incline, A. F. Rogers (39) p. 161, Melhase (5) no. 9, p. 4. Its atomic structure was studied by Pabst (7) p. 372.

GILSONITE

A variety of asphalt

Color black, brilliant and lustrous. Streak a rich brown. H. = 2-2.5. G. = 1.065-1.070. Fuses easily in the flame of a candle, and burns with a brilliant flame.

Santa Barbara County: **1,** Found on the Goldtree Ranch, Sisquoc, Irelan (4) p. 47.

GLASERITE

See aphthitalite

GLAUBERITE

Sulphate of sodium and calcium, $Na_2SO_4 \cdot CaSO_4$

Monoclinic. Tabular crystals. Cleavage perfect basal. Brittle. Vitreous luster. Color yellowish white, gray. Streak white. H. = 2½-3. G. = 2.7-2.85.

Fuses easily, coloring the flame yellow. Partly soluble in water and completely soluble in dilute acid.

Imperial County: **1,** Good crystals of glauberite have been found in the mud of the dry lake half a mile east of Bertram siding on the Southern Pacific Railroad, Murdoch (p. c., '45).

Inyo County: **1,** It is found with halite in the salt pools at Pluto Wells in the bottom of Death Valley, H. S. Gale (13) p. 303. It also appears here in drill cores down to a depth of 100 feet, ibid. **2,** Specimens have been collected from the playa in Saline Valley, ibid, p. 303.

Lake County: **1,** Thin, flattened crystals have been found in blue clay 40 feet below the surface at Borax Lake, Silliman (10) p. 399, Hanks (12) p. 182, Vonsen (3) p. 22.

San Bernardino County: **1,** Glauberite is common at Searles Lake, in platy crystals, Rath (5) p. 233, De Groot (3) p. 535, H. S. Gale, (13) p. 303.

GLAUBER SALT

See mirabilite

GLAUCONITE

Essentially a hydrous iron, aluminum, and potassium silicate, $K_2(Mg,Fe)_2Al_6(Si_4O_{10})_2(OH)_{12}$

Monoclinic. Cryptocrystalline or granular. One perfect cleavage. Dull or glistening luster. Color olive green, blackish green, yellowish green, grayish green. H. = 2. G. = 2.2-2.4.

Fuses easily to a dark magnetic glass. Some varieties are entirely decomposed by hydrochloric acid, while others are not appreciably attacked. Yields water.

It is found abundantly in ocean sediments near the continental shores.

Butte County: **1**, A 2-foot layer of glauconite-anauxite sandstone occurs in Chambers Ravine, 4 miles north of Oroville, V. T. Allen (3) p. 369.

Los Angeles County: **1**, It is found with glaucophane and crossite in siliceous shale at Malaga Cove, near Redondo, Reed (5) p. 347.

Merced County: **1**, Glauconite occurs with jarosite in sandstone, sec. 35, T. 11 S., R. 10 E., M.D., 10 miles south of Los Banos, Briggs (1) p. 902.

Monterey County: **1**, It has been found in dredgings from Monterey Bay, Galliher (2) p. 1359, (3) p. 1580.

San Diego County: **1**, It occurs extensively with collophane on submarine banks off the coast, Dietz et al. (2) p. 819.

GLAUCOPHANE

See amphibole, soda amphibole

GOETHITE

Hydrous oxide of iron, $HFeO_2$

Orthorhombic. Slender prisms, vertically striated. Also fibrous, massive. One perfect cleavage. Brittle. Adamantine to submetallic luster. Color yellowish, reddish, and blackish brown. Streak yellowish brown. H. = 5-5½. G. = 4.28.

Distinguished from the more common "limonite" by its crystalline-fibrous and columnar structure and cleavage. In the closed tube it gives off water and is converted into red iron sesquioxide. Soluble in hydrochloric acid.

Goethite is usually found as slender prismatic crystals in masses of limonite or hematite, and resembles limonite so closely that it is often classed as such.

Inyo County: **1**, Goethite has been found with chrysocolla and limonite at the St. Ignacio mine (N. R.).

Mariposa County: **1**, Found in quartz on Burns Creek, Kunz (24) p. 105.

Riverside County: **1**, A very small amount has been found in the Iron Age ore deposit near Dale, in the Eagle Mountains, Harder (6) p. 63.

GOLD

Native gold, Au

Isometric. Good crystals are rare. Common in grains, scales, plates, and arborescent forms. No cleavage. Highly malleable and ductile. Metallic. Color and streak gold yellow. H. = 2½-3. G. = 15.6-19.3.

Unaffected by any single acid, but soluble in the combined hydrochloric-nitric acids called aqua regia. Its insolubility in nitric acid distinguishes it from chalcopyrite and pyrite.

Native gold has a very wide distribution in California. It has been found in every county, and is now produced in two-thirds of them. It occurs either as free flakes or nuggets in sands and gravels, or in quartz veins, either alone, or more commonly with small amounts of pyrite, arsenopyrite, or other sulphides. It is sometimes in such fine particles in the quartz as to be invisible to the naked eye, or it may occur in minute grains in massive sulphides, or in the "limonite" gossans derived from their weathering. Less commonly it is finely disseminated in slates or greenstones. It has been found associated with any one of a long list of

minerals, but is most common in quartz. A somewhat unusual association is with cinnabar, and occurrences of this type are listed below. Calcite, barite, arsenopyrite, and pyrite are common gangue minerals, and gold and silver tellurides are occasionally found with the native metal.

Gold occurs in nuggets, flakes, stringers of a great variety of shapes: arborescent, spongiform, wires, plates, and less commonly, well-formed crystals. Small octahedral crystals were described and figured by Alger (1) p. 102. C. U. Shepard (1) p. 231, has described some gold crystals two-fifths of an inch in diameter. W. P. Blake (11) p. 120, noted one cavernous crystal nearly 2 inches on its longest side [probably from Forest Hill, Placer County, ibid. (7) p. 299]. Blake's report in November 1861 on the Mariposa Estate, quoted in J. R. Browne (4) p. 25, describes specimen gold ". . . crystals are bunches of tetrahedrons with perfectly flat and polished faces from $\frac{1}{8}$ to $\frac{3}{16}$ inches across, and are attached to masses of white quartz."

Numerous large nuggets and masses of gold and quartz have been found in the stream gravels and in the "pockets" of quartz veins. The first large nugget, weighing between 20 and 25 pounds, was found in 1848 on the Mokelumne River, by a soldier in Stevenson's regiment, Hanks (8) p. 148. A great number have been discovered since that time. A complete list would be too long to insert here, but probably well over 60 big finds, and hundreds of smaller ones, have been recorded, with the large ones ranging from 50 to 2300 ounces Troy weight. More detailed records of nuggets may be found by consulting the following references: Hittel (2) p. 492; Mining and Scientific Press (12) p. 178; ibid. (23) p. 162; Hanks (8) pp. 147-150; W. W. Allen and Avery "The California Gold Book" (1) p. 91; Hurley (1); Del Mar (1) p. 629.

The largest nugget on record, found at Carson Hill in 1854, weighed 2340 ounces. Several others nearly as large have been found at various times: Holden's Garden, El Dorado County, 1500 ounces (1850); Monumental mine, Sierra Buttes, 1596 ounces (1860), and 1893 ounces (1869). More large nuggets have come from Sierra County than from any other, with El Dorado County next. In Tuolumne County a great many nuggets weighing from 2 to 70 pounds were found between 1850 and 1858, in a 5-mile radius including Sonora, Columbia, and Springfield. A list of 25 or more of these is given by Hittel (2) p. 492. Coming down to more recent times, a $3,000 nugget was found in Siskiyou County in 1903, Engineering and Mining Journal (8) p. 49. Several large masses of practically pure crystallized gold have been found at various places within 3 years of 1935, Laizure (8) p. 29.

Primary deposits occur along the Mother Lode belt, at various points in the Sierra Nevada, east and north of the Lode, and in isolated ranges in the northwestern and southeastern parts of the state. The western slopes of the Sierra Nevada where the main streams leave their deep canyons to enter the valley, the large river courses in the northwest, and parts of the desert regions in the southeastern part of the state are important placer mining areas.

Some gold is found in the Coast Range and some is mined in the southern counties, but the great bulk of it comes from the northern half of the state and from counties along the Sierra Nevada.

Gold occurs is so many localities in the state that it would be impossible to cite all of them. The literature on the gold deposits is also extensive. The gold placers of California have been described in Bulletin 92 of the State Division of Mines, and the Mother Lode gold belt has been described in Bulletin 108. Professional Papers 73 and 157 of the United States Geological Survey are the best authorities on the Tertiary gravels of the Sierra Nevada and the Mother Lode gold belt, respectively.

The leading lode-gold producing counties of the state are: Amador, Calaveras, El Dorado, Kern, Mariposa, Nevada, Shasta, Siskiyou, Sierra, Trinity and Tuolumne.

The leading placer-gold producing counties of the state are: Butte, Merced, Placer, Sacramento, Stanislaus, and Yuba.

For contemporary pictures and information concerning the early days of gold in California, see Egenhoff (1).

Alameda County: **1**, Stringers of quartz with visible free gold were found on the west and north slopes of the Berkeley Hills, Lawson (7) p. 23.

Amador County: **1**, Talc filled with gold particles came from the Soapstone Lode, Engineering and Mining Journal (2) p. 195. **2**, A ribbon of solid gold three-eighths of an inch or more in thickness was found in the old Eureka mine (sec. 8, T. 6 N., R. 11 E., M. D.), Logan (16) p. 101 [quotation from a report by John B. Trask, 1855].

Butte County: **1**, A nugget weighing 832 ounces came from the Willard claim near Magalia, J. D. Hubbard (1) p. 353. **2**, Gold in barite gangue came from Pinkstown Ledge, half a mile south of Big Bend Mountain, Turner (12) p. 588.

Calaveras County: **1**, The largest mass of gold quartz ever reported in California came from the Morgan mine and was valued at $43,534, Logan (16) p. 129. See also Tuolumne County, (3).

Colusa County: **1**, Gold deposited on quartz crystals occurred in the Manzanita cinnabar mine on Sulphur Creek. This mine was worked for gold from 1865-92, Aubury (2) p. 44.

El Dorado County: **1**, Near Coloma, 3 miles from Sutter's Mill, a specimen was found weighing 31 ounces, a beautiful mass with a delicately marked surface consisting of a network of fibers, W. P. Blake (3) p. 79. **2**, A mass of gold in imperfect crystals was found 7 miles from Georgetown, in 1866, W. P. Blake (11) p. 120. **3**, A beautiful specimen—large crystalline plates studded with triangular markings was found at Spanish Dry Diggings, E. S. Dana (3) p. 138. **4**, Gold occurred in albite at the Shaw mine, Storms (6) p. 173.

Humboldt County: **1**, Gold washed out of the black sands of the sea cliffs at Upper Gold Bluffs was observed to form a nearly complete coating of the beach sands. This coating was temporary, and was dissipated with the next tide, S. Johnson (1) p. 536. R. W. Raymond (7) p. 145 described the bluff and showed a structure section.

Inyo County: **1**, Gold occurs in purple fluorite, producing an unusual appearing ore, at the Waterfall prospect, 3 miles north of Antelope Springs, A. Knopf (5) p. 113. **2**, Microscopic octahedral crystals were found at the Ida mine, Hanks (12) p. 184. **3**, A nugget weighing 39½ ounces was reported from the Halleluja claim, at the north end of Death Valley, Los Angeles Times, July 30, 1945.

Lake County: **1**, Gold nuggets with attached cinnabar were found near Sulphur Springs, Bear Valley, 10 miles northeast of Borax Lake, J. A. Phillips (1) p. 326.

Los Angeles County: **1**, One of the early discoveries of gold was made on the San Francisquito Ranch in June 1841, J. J. Warner (1) p. 170.

Mariposa County: **1**, "Crystals [of gold] are bunches of octahedrons with perfectly flat and highly polished faces from $\frac{1}{8}''$ to $\frac{3}{16}''$ across," at the Princeton mine, Mariposa Estate, J. R. Browne (4) p. 25 quoting W. P. Blake's report of November 1861.

Nevada County: **1**, Gold associated with altaite occurred at the Providence mine, Lindgren (12) p. 116. **2**, Beautiful leaf gold occurred in cavities lined with quartz crystals, at the Granite Hill and North Gold Hill veins, ibid. p. 115. **3**, Wires of gold were found on large crystals of pyrite at the Pennsylvania mine, Nevada City, E. MacBoyle (1) p. 43. **4**, Beautiful plates and angular masses of gold in snow-white quartz, often associated with brilliant crystals of arsenopyrite, were found at the Lafayette and Helvetia mines, W. P. Blake (3) p. 76.

Placer County: **1**, Several octahedral crystals three-eighths of an inch across, and a large "skeleton" crystal 1 by $\frac{7}{8}$ inches, came from Forest Hill, W. P. Blake (3) p. 78, (7) p. 299. **2**, Several beautiful arborescent specimens of gold were found on Irish Creek. One (12 by 4 inches in dimensions) was in the form of a leaf, with one side arborescent and the other studded with 25 perfect octahedrons, W. P. Blake (3) p. 78. **3**, A mass, nearly all gold, weighing 187 ounces was found 2 miles above Michigan Bluff on American River, W. P. Blake (16) p. 166.

Santa Clara County: **1**, Gold has been found in red garnets of the eclogite at Coyote Creek, 6 miles north of San Martin, Holway (1) p. 347.

Shasta County: **1**, A slab of gold nearly a quarter of an inch thick, weighing 100 ounces, came from the Mad Mule mine in Grizzly Gulch, northeast of Tower House, Ferguson (3) p. 251. Normally the gold here occurs as thin films or as dendritic forms in calcite.

Sierra County: **1**, A large nugget or mass from the vein, weighing about 95 pounds, came from the Monumental mine, near Sierra Buttes, Newberry (2) p. 10. The original mass was probably as much as 140 pounds.

Siskiyou County: **1**, Thin triangular plates of gold with a hexagonal pattern came from Yreka, E. S. Dana (3) p. 138. **2**, A mass of leaf gold from Quartz Valley, 25 miles from Yreka, was valued at $6,000, Engineering and Mining Journal (11) p. 828. **3**, Gold occurring in conglomerate was reported from the Cottonwood district, Turner (25) p. 653.

Tuolumne County: **1**, A large nugget weighing $209\frac{1}{2}$ ounces was found at Sonora, Du Bois (1) p. 177, (2) p. 175. **2**, Numerous large nuggets have come from a small area including Sonora, Columbia, Springfield, and Shaws Flat, Hittel (2) p. 300. **3**, Small brilliant prisms of gold (distorted crystals) have come from Sonora, and Angels Camp in Calaveras County, W. P. Blake (11) p. 57. **4**, Wire gold resembling a braided cord was found at the Golden Rule mine, S.M.B. (15176). **5**, Placer gold was reported as commonly coated with quicksilver, at Curtis Creek, J. S. Wilson (1) p. 315. **6**, A beautiful specimen of gold found in loose quartz crystals and talc measured 6 x 13 inches and weighed 67 ounces. Found in 1946 on the Eureka and Grizzly claim, $E\frac{1}{2}$ $E\frac{1}{2}$ sec. 26, T. 1 S., R. 15 E., M.D., Logan (23) p. 65.

GOLD, var. ARGENTIAN (ELECTRUM)

Alloy of gold and silver

Colusa County: 1, Argentian gold was mined with cinnabar and sulfur from Sulphur Creek, E. S. Dana (5) p. 1096.

Fresno County: 1, Reported from the Jeff Davis mine near Millerton, Hanks (3) p. 25.

Inyo County: 1, Reported from Kearsarge district, Hanks (15) p. 135.

Lassen County: 1, Occurred with free gold from Hayden Hill district, Preston (1) p. 212.

Madera County: 1, Wire argentian gold was found at the Hanover mine, Fine Gold Gulch (S.M.B. 1598), Hanks (14) p. 89.

Mono County: 1, Reported from Bodie, Hanks (3) p. 25 and (12) p. 190.

Placer County: 1, It occurred in the Moore and other mines of the Ophir district, Lindgren (7) p. 271.

Tulare County: 1, Reported from the White River, Angel (2) p. 732.

GOLD AMALGAM

A native alloy of gold and mercury very rarely found

Mariposa County: 1, Found in the region around Mariposa, noted first by Schmitz (1) p. 713, and analyzed by Sonnenschein (1) p. 244.

Nevada County: 1, Reported from the Odin drift mine near Nevada City, Lindgren (12) p. 116.

GONNARDITE

Hydrous calcium, sodium, and aluminum silicate, $Ca_4Na_8Al_{16}Si_{24}O_{80} \cdot 28H_2O$

Orthorhombic. Fibrous, radiating. Silky luster. Color white. H. = 4½-5. G. = 2.3.

Riverside County: 1, Gonnardite was found in white, silky, radiated fibers with wollastonite and pyrite in the Commercial quarry at Crestmore, Foshag (p.c., '36).

GOSLARITE

Hydrous zinc sulphate, $ZnSO_4 \cdot 7H_2O$

Orthorhombic. In long acicular crystals and massive crusts. One perfect cleavage. Brittle. Vitreous luster. Color white, reddish, yellowish. H. = 2. G. = 2.

Reduced with soda on charcoal, gives yellow coating, which turns green when heated with cobalt nitrate. Yields water in closed tube. Easily soluble in water. Taste astringent.

Goslarite is formed through the decomposition of sphalerite and is sometimes found on mine walls.

Shasta County: 1, It is reported from some of the copper deposits in the county, Graton (3) p. 100.

Trinity County: 1, It occurs with other sulphate minerals in the alteration products at Island Mountain, Langdon (1) p. 279.

GRAPHIC TELLURIUM

See sylvanite

GRAPHITE—Plumbago—Black Lead

Native carbon, C

Hexagonal-rhombohedral. In six-sided tabular crystals. Commonly in embedded foliated masses, also columnar or radiated; scaly or slaty;

granular to compact; earthy. Cleavage basal, perfect. Thin laminae flexible, inelastic. Feel greasy. Luster metallic, sometimes dull earthy. Iron-black to dark steel-gray. Streak gray. H. = 1-2. G. = 2.09-2.23.
B. B. infusible. Unaltered by acids.

Graphite is prominent in some schists and gneisses and when present in considerable amount the graphitic gneiss or schist is sometimes mined for the graphite. In mining districts it is often seen coating the walls of veins and mixed with the talcose gouge.

It is a common constituent of crystalline limestones and is often disseminated through the limestone in minute flakes and in larger foliated masses.

No extensive deposits of good quality graphite are known to occur in the state, but a few small deposits have been worked for the manufacture of paints and lubricants. Much of the graphite of California is so intimately mixed with silica that its separation as pure material is an expensive operation. It is typically a constituent of metamorphic rocks and as such may be found in every county.

Amador County: **1**, Graphite is rather abundant at the Argonaut mine, Josephson (1) p. 475.

Calaveras County: **1**, It has been mined at Campo Seco, Bastin (1) p. 197.

Del Norte County: **1**, Foliated plates of graphite in limestone are found 18 miles northeast of Crescent City, Irelan (3) p. 164.

Fresno County: **1**, It is prominent in the rocks on the Reeves Ranch, 3½ miles west of Dunlap, Crawford (2) p. 642. **2**, At Borer Hill, Hanks (12) p. 224. **3**, Graphitic schists are found east of Squaw Valley (T. 14 S., R. 24 E., M. D.). **4**, At Sycamore Creek near Trimmer, W. W. Bradley (2) p. 451.

Imperial County: **1**, A large deposit of good graphite occurs on the southeast slope of Coyote Mountains 7 miles north of Coyote Wells, Tucker (4) p. 267.

Kern County: **1**, Graphite was noted near Fort Tejon, J. R. Browne (4) p. 254.

Los Angeles County: **1**, A rather considerable deposit occurs in the Verdugo Hills (sec. 4, T. 1 N., R. 13 W., S. B.), Aubury (3) p. 280. **2**, Graphite schist occurs in Kagel Canyon, 8 miles east of San Fernando, Beverly (1) p. 349. **3**, Two deposits are in Pacoima Canyon (sec. 17, T. 3 N., R. 15 W., S. B.), ibid. p. 351. **4**, Several deposits (graphitic schist) have been found near the head of San Francisquito Canyon (T. 6, 7 N., R. 15, 16 W., S. B.), ibid. p. 349. **5**, Crystalline graphite in a biotite-sillimanite schist occurs near Elizabeth Lake Canyon (T. 7 N., R. 15 W., S. B.), ibid. p. 351. **6**, A deposit in Bouquet Canyon (secs. 11, 12, T. 6 N., R. 15 W., S. B.), has been worked occasionally for a considerable period, Simpson (1) p. 410.

Marin County: **1**, A deposit of graphite has been reported from the border of Tomales Bay, Walker (1) p. 915.

Mendocino County: **1**, Graphite has been mined east of Point Arena (sec. 8, T. 12 N., R. 15 W., M. D.), Aubury (3) p. 280.

Monterey County: **1**, Occurs in lustrous flakes in most of the limestones of the Sur series, P. D. Trask (2) p. 131.

Nevada County: **1**, A deposit carrying 26 percent carbon was reported at the Black Quartz mine, near Washington, Mining and Scientific Press (42) p. 840.

Riverside County: **1**, Graphite flakes are abundant in the brucite limestone at Crestmore, Woodford et al. (10) p. 354. **2**, Crystals as much as 2-3 millimeters in size occur associated with wollastonite in the crystalline limestone at the Jensen quarry, Peebles (p.c., '44).

San Bernardino County: **1**, Large deposits are reported near the head of the Santa Ana River, 15 miles from East Highlands, Aubury (3) p. 280. **2**, Fine-grained graphite schist comes from Eva Canyon half a mile to 1 mile from its mouth, Bastin (2) p. 164. **3**, Graphitic schist occurs in Green Canyon, in the Big Bear Lake area, secs. 28, 29, 32, 33, T. 2 N., R. 2 E., S. B., Wright et al. (5) p. 166.

San Diego County: **1**, Graphite in mica schist is reported near Mason, (sec. 34, T. 13 S., R. 5 E., S. B.), Tucker (4) p. 378. **2**, "Black mica" presumably graphite was reported in 1792 by Martinez (1) p. 40, as occurring "near San Diego."

Sonoma County: **1**, Small deposits of graphite and graphitic schists occur southwest of Healdsburg, Aubury (3) p. 281. **2**, Near Petaluma, ibid., p. 281. **3**, In Knights Valley, Hanks (12) p. 225.

Tulare County: **1**, A large low-grade deposit (Camp Nelson graphite) occurs in sec. 34, T. 20 S., R. 31 E., M. D., Franke (1) p. 444. **2**, Graphite schist is found in Drum Valley, Aubury (3) p. 280.

Tuolumne County: **1**, Graphite was mined at an early date at the Eureka plumbago mine (discovered in 1853) (E. ½ sec. 24, T. 2 N., R. 14 E., M. D.), J. R. Browne (4) p. 252, Logan (23) p. 75.

GRAY COPPER ORE

See tetrahedrite

GREENOCKITE

Cadmium sulphide, CdS

Hexagonal. Generally as thin coatings. Cleavage distinct. Brittle. Adamantine to resinous luster. Color and streak orange yellow. H. = 3-3½. G. = 4.9-5.0.

Mixed with sodium carbonate and heated on charcoal, a coating is obtained which is reddish brown near the assay and yellow beyond. Soluble in hydrochloric acid.

A very rare mineral occasionally found coating sphalerite.

Xanthochroite has been shown to be identical with greenockite, Palache et al. (10) p. 230.

Inyo County: **1**, Orange yellow prismatic crystals were found in a vein with hemimorphite at Cerro Gordo, Woodhouse (p. c., '45).

Mono County: **1**, Rock specimens from T. 8 N., R. 22 E., M. D., were coated with brilliant yellow to orange greenockite (*xanthochroite*), Schaller (34) p. 137. Other specimens show as a coating on magnetite, S. M. B. (18924), Eakle and McLaughlin (17) p. 141.

Riverside County: **1**, Thin coatings of greenockite were found on sphalerite at Crestmore, Eakle (15) p. 352.

San Bernardino County: **1**, Thin coatings of greenockite were found on quartz from the San Bernardino Mountains (sec. 31, T. 1 N., R. 1 E., S. B.), W. W. Bradley (30) p. 194.

Santa Clara County: **1**, S. M. B. (18467) was sent in from this county.

Shasta County: **1**, Several thousand pounds of cadmium were produced at the Mammoth Copper Company plant, presumably from cadmium in the sphalerite. This may in part be as greenockite associated with the sphalerite, Hamilton (4) p. 241.

* GRIFFITHITE, 1917

Hydrous magnesium, iron, calcium, and aluminum silicate, $4(Mg,Fe,Ca)O \cdot (Al,Fe)_2O_3 \cdot 5SiO_2 \cdot 7H_2O$

Monoclinic. Basal plates and shreds. Cleavage basal. Sectile. Color dark green. H. = 1. G. = 2.309.

Fuses with intumescence to a black magnetic slag. Soluble in hydrochloric acid with gelatinization.

Los Angeles County: 1, Griffithite, a variety of chlorite, occurs in amygdules up to 1 inch across in basalt of Cahuenga Pass. Named by Larsen and Steiger (6) p. 11.

Analysis (by Steiger)

SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO
39.64	9.05	7.32	7.83	15.80	2.93
Na_2O	K_2O	H_2O-	H_2O+	TiO_2	
0.71	none	12.31	4.90	none = 100.49%	

2, Griffithite occurs in the Pacific Electric quarry, Brush Canyon, locality 2, Neuerburg (1), p. 136.

GROSSULARITE

See garnet

GRÜNERITE

See amphibole

GUADALCAZARITE

Zincian metacinnabar, (HgZn)S,Zn:Hg up to at least 1:6

Santa Clara County: Minute rhombohedral-hemimorphic crystals from New Almaden described by Melville (2) p. 292 as metacinnabar, should be called guadalcazarite, Wherry (3) p. 37. According to Palache et al. (10) p. 216, however, guadalcazarite is simply a zinc-bearing metacinnabar. It is possible that these crystals were wrongly identified as to their form.

GÜMBELITE

Composition essentially the same as muscovite, but habit fibrous instead of platy.

San Bernardino County: 1, Fine fibrous material from NE¼ sec. 33, T. 1 S., R. 5 W., S. B., between Bloomington and Jensen's quarry, has nearly the composition of muscovite, but is not micaceous, and is considered by Woodford (p. c., '45) to be probably gümbelite.

GUMMITE

Hydrous uranium oxide, $UO_3 \cdot nH_2O$

Massive. Dense rounded or flattened masses or crusts, and as pseudomorphs. Fracture conchoidal to uneven. Brittle. H. = 2½-5. G. = 3.9-6.4. Luster greasy to waxy or vitreous. Color yellow, orange, reddish yellow, to orange- or hyacinth-red, to red-brown to black. Streak yellow, brownish, olive green.

Gummite has the same relationship to well-defined uranium oxides that limonite and wad have to oxides of iron and manganese. It may actually be largely *curite* ($2PbO \cdot 5UO_3 \cdot 4H_2O$?)

Kern County: 1, Gummite is tentatively reported in quartzite float in the McKittrick-Taft area, Anon. (28) p. 2.

GYPSITE

See gypsum

GYPSUM

Hydrous calcium sulphate, $CaSO_4 \cdot 2H_2O$

Monoclinic. Crystals flattened or prismatic to acicular. Massive, granular, fibrous, lamellar. One perfect cleavage. Pearly to subvitreous luster. Colorless, white, gray, light brown, reddish. Streak white. H. = 1½-2. G. = 2.31-2.32.

Fuses at 2.5-3. Easily soluble in dilute hydrochloric acid. Gives water in a closed tube and crumbles to a white powder.

Selenite, satin spar, alabaster, and *gypsite* are varietal names. The granular, bedded, and efflorescent deposits are the only ones of value in the state and the term "gypsite" is generally applied to the material of such deposits.

Gypsum is a very common mineral. Since it is easily formed by the action of sulphate waters on limestone, small amounts of gypsum are common in mining regions where sulphides are decomposing. Larger bodies are generally bedded deposits formed by the evaporation of calcium-sulphate waters; these are apt to be impure from admixtures of calcium carbonate and clay. The principal gypsum deposits of the state have been described by Hess (16) pp. 58-86, and Ver Planck (2).

Calaveras County: **1**, Platy aggregates of gypsum occur with quartz at the Utica mine, Angels Camp, A. Knopf (11) p. 37.

Fresno County: **1**, Gypsite of good quality occurs in beds 3-15 feet thick at the Paoli mine, Tumey Gulch (SW¼ sec. 1, T. 16 S., R. 12 E., M. D.) and on adjacent lands, Hess (9) p. 9. **2**, Several deposits are near Coalinga (sec. 21, T. 19 S., R. 15 E., sec. 22, T. 20 S., R. 14 E., M. D.) ibid., p. 9. **3**, Satin spar has been found at the San Joaquin coal mine (sec. 26, T. 20 S., R. 14 E., M. D.) W. W. Bradley (2) p. 452.

Imperial County: **1**, An extensive deposit of good quality gypsum, some of it in large cleavage plates, occurs with associated celestite, in the Fish Creek Mountains (T. 13 S., R. 8, 9 E., S. B.), Tucker (11) p. 271. **2**, Another extensive deposit occurs 3 miles northwest of Coyote Wells, Tucker (4) p. 267. Emory (1) p. 103 noted gypsum and mica crystals on the approaches to Carizzo Gorge, which may be near this deposit.

Inyo County: **1**, Several beds of pure white gypsum, 6 to 10 feet thick are reported from China (Morrison) ranch 1 mile northeast of Acme Station, Tonopah and Tidewater Railroad, Hess (16) p. 63. **2**, Six-inch veins of transparent selenite have been found in the Upper Canyon Bed niter deposits, G. E. Bailey (2) p. 172. **3**, Small crystals of gypsum are associated with glauberite and halite in the muds at Pluto Springs in the bottom of Death Valley, Webb (p. c., '45).

Kern County: **1**, Gypsite has been found in extensive deposits at a number of localities on the west side of the San Joaquin Valley (T. 25, 26, 30, 32 S., R. 18, 22, 23, 24 E., M. D.), Hess (16) pp. 64, 65, Fairbanks (20) p. 123. **2**, Beds up to 10 feet thick are found southeast of Cane (Koehn) Springs, (sec. 28, T. 30 S., R. 38 E., M. D.), Hess (16) p. 73. **3**, Good gypsum crystals have been found at the San Emigdio mine. W. P. Blake (5) p. 308.

Los Angeles County: **1**, Loose, well-formed crystals in sand and clay have been found half a mile from the shore, north of Sunset Boulevard, Murdoch (p. c., '45).

Mono County: **1,** Selenite crystals are occasionally found in the tubes of tufa at Mono Lake, I. C. Russell (1) p. 311.

Napa County: **1,** Good crystals of gypsum have been found in the Palisades mine, 2 miles north of Calistoga, Hulin (p. c., '36).

Nevada County: **1,** Gypsum in stellate radial groups up to 3 inches in diameter was found near Truckee Pass, Hanks (12) p. 226.

Riverside County: **1,** Good crystals of gypsum can be found in tunnels in Gypsum Canyon, 2 miles south of Corona, Hess (16) p. 77. **2,** Extensive deposits of gypsum associated with anhydrite occur at the Midland mine of the U. S. Gypsum Company, in the Little Maria Mountains, Campbell (p. c., '36). **3,** Another large deposit is 3 miles north of Packards Well, at the north end of Palen Mountains, F. J. H. Merrill (2) p. 579. **4,** Thick beds of gypsum occur in the Maria Mountains (T. 3, 4 S., R. 21 E., S. B.), F. J. H. Merrill (2) p. 577.

San Bernardino County: **1,** Crystals, and cleavage slabs of selenite occur in veins in the borate beds of the Calico Hills, G. E. Bailey (2) p. 58, Hamilton (3) p. 352. **2,** Massive gypsum occurs in secs. 15, 22, etc. T. 18 N., R. 5 E., S. B., in the Avawatz Mountains, Hess (16) p. 82. **3,** Extensive beds interstratified with salt are present in the Avawatz Mountains, Cloudman et al. (1) p. 869. **4,** It is one of the minor minerals at Searles Lake, H. S. Gale (13) p. 297. **5,** It occurs in Amboy Sink at Bristol playa, Gale, H. S. (17), p. 5.

Santa Barbara County: **1,** Alabaster occurs on a branch of Santa Barbara Creek (SE¼ sec. 34, T. 9 N., R. 25 W., S. B.), Hess (16) p. 84. **2,** Crystals are reported from Santa Rosa Island, S. M. B. (12313). **3,** Large quantities are found at Point Sal, Fairbanks (14) p. 16.

Siskiyou County: **1,** Abundant gypsum crystals are found with crystallized sulphur at a spring at the summit of Mount Shasta, H. Williams (2) p. 240.

Ventura County: **1,** Massive gypsum is interbedded with diatomaceous shale 4 miles south of Fillmore (sec. 12, T. 3 N., R. 20 W., S. B.), Huguenin (2) p. 761. **2,** A 40-foot bed of pure gypsum is reported at French Point Hill, in the Cuyama Valley, Angel (2) p. 599. **3,** Selenite and massive gypsum are found at the Russell borax mine, north of Lockwood Valley, H. S. Gale (11) p. 446.

Occurrences of no particular commercial or mineralogic interest have been reported from the following counties: *Butte,* S. M. B. (7235); *Kings,* Hess (9) p. 14; *Los Angeles,* Hess (16) p. 75, Simpson (1) p. 412; *Merced,* Watts (1) p. 331; *Orange,* S. M. B. (12216); *San Benito,* Fairbanks (20) p. 120, W. W. Bradley and Logan (7) p. 639; *San Bernardino,* Hess (16) p. 81, Tucker and Sampson (17) p. 382; *San Francisco,* Eakle (1) p. 316; *San Joaquin,* S. M. B. (13885); *San Luis Obispo,* Hanks (12) p. 226, Crawford (1) p. 325; *Solano,* J. D. Dana (2) p. 656; *Stanislaus,* Hanks (12) p. 266; *Tulare,* Hanks (12) p. 226.

GYROLITE

Hydrous calcium silicate, $Ca_4Si_6O_{15}(OH)_2 \cdot 3H_2O$

Hexagonal-rhombohedral. Fibrous and lamellar concretions. Perfect basal cleavage. Vitreous luster. Colorless and white. H. = 3-4. G. = 2.34-2.45.

Fuses easily to a blebby glass and gives the yellowish-red flame of calcium. Soluble in acid with some gelatinization. Gives water in a closed tube.

Gyrolite is formed as a secondary mineral in crevices of rocks by the alteration of lime silicates.

San Francisco County: **1**, Found as spherical or massive platy or plumose aggregates replacing wall rock in fissures of basalt at Fort Point, San Francisco, Schaller (8) p. 124.

Santa Clara County: **1**, A fibrous layer 1 to 3 centimeters thick was found associated with apophyllite and bitumen in veins at the New Almaden mine, Clarke (4) p. 128.

HALITE—Common or Rock Salt

Sodium chloride, NaCl

Isometric. Cubes, massive, granular, and crusts. Cleavage, perfect cubic. Rather brittle. Vitreous luster. Colorless, white, yellowish, reddish, bluish. H. = $2\frac{1}{2}$. G. = 2.1-2.6.

Fuses with intumescence and gives a strong yellow flame. Easily soluble in water and has a saline taste.

Most of the salt produced in the state is obtained by the evaporation of the water of San Francisco Bay; also at San Diego and Monterey Bays. Extensive deposits of the mineral exist in the southern counties and some of them are mined. Salt is common in the desert regions, where former lakes existed, and the deposits reach considerable thickness in some localities, often alternating with beds of sulphates, borates, carbonates, and mud shales. Salt wells, salt springs, salt marshes, and salt rivers occur in these arid plains, and white incrustations of salt are often found along their borders.

Almost all of the desert playas in Imperial, Inyo, Kern, Riverside, San Bernardino, and San Luis Obispo Counties have incrustations, or sometimes considerable layers, of halite in the dry season. G. E. Bailey (2) pp. 110-134 records in detail many of these occurrences.

Alpine County: **1**, Hopper-shaped crystals have been found around pools, and in glacial potholes, at Hams Salt Springs, on the north fork of the Mokelumne River, Turner (1a) p. 453.

Lake County: **1**, Slender square prismatic crystals were found at Borax Lake, Vonsen (3) p. 25.

San Bernardino County: **1**, Octahedral crystals of halite have been found at Searles Lake, where the main beds are solid halite, H. S. Gale (13) p. 298. **2**, Extensive beds of rock salt occur on the north flank of the Avawatz Mountains, G. E. Bailey (2) p. 126. Phalen (3) p. 526. **3**, Large quantities of salt have been produced from Danby Dry Lake, G. E. Bailey (2) p. 128. **4**, From Amboy Sink, Bristol playa, southeast of Amboy, Tucker (4) p. 357, Gale, H. S. (17) p. 6.

HALLOYSITE

Hydrous aluminum silicate, $Al_4Si_4O_{10}(OH)_8 \cdot H_2O$

Massive. Earthy, clay-like. Slightly plastic. Waxy to dull luster. Color white, grayish, greenish, reddish, brown. H. = 1-2. G. = 2-2.2.

Like kaolinite in its blowpipe reactions. Generally classed as a clay.

Imperial County: **1**, Halloysite has been recorded in association with realgar and claudetite 6 miles north of the 4S Ranch, $1\frac{1}{2}$ miles west of the Colorado River, Kelley (1) p. 137.

Inyo County: **1**, Banded white and brown, and massive white, halloysite has been found at the Cerro Gordo mine, A. F. Rogers (7) p. 381, A. Knopf (8) p. 115.

Mono County: 1, Halloysite from the Detroit copper mine near Mono Lake has been analyzed, Clarke and Chatard (1) p. 23, (2) p. 12.

San Diego County: 1, The so-called "pay streak" of pink clay in the pegmatite mines at Pala is halloysite, Schaller (3) p. 191. It occurs in large seams several inches thick and many feet in length.

HALOTRICHITE—Iron Alum

Hydrous aluminum and iron sulphate, $FeSO_4 \cdot Al_2(SO_4)_3 \cdot 22H_2O$

Monoclinic. Fibrous. Silky luster. Color yellowish white. H. = 2. G. = 1.9.

Fusible. Soluble in water. Ink taste. Ammonia precipitates iron and alumina from solution. Barium chloride precipitates barium sulphate. Gives much water in a closed tube.

Alpine County: 1, Found as incrustations and thin seams at the Leviathan sulphur mine, Gary (1) p. 488, Nichols (1) p. 172.

Alameda County: 1, Occurs as fibrous masses in the Eureka tunnel near Livermore (N.R.).

Contra Costa County: 1, Found at the Diablo mine (SE¼ sec. 29, T. 1 N., R. 1 E., M. D.), C. P. Ross (2) p. 42.

El Dorado County: 1, Occurrence reported by gift of specimen, S. M. B. (21343).

Los Angeles County: 1, Occurs with melanterite in altered boulders of a conglomerate, in a road cut on Cahuenga Peak (S½SW¼ sec. 25, T. 1 N., R. 14 W., S. B.), Neuerburg (1) p. 159.

San Bernardino County: 1, Found with other sulphates in the "sulphur hole" close to the borax mines, Calico Hills, Foshag (19) p. 352.

Shasta County: 1, It is found as incrustations around springs on Lassen Peak, Day and Allen (1) p. 118.

Sonoma County: 1, Halotrichite occurs sparingly at the Geysers, and is reportedly rich in nickel, Vonsen (6) p. 290.

Trinity County: 1, It occurs in tufts at the Island Mountain pyrrhotite mass, Vonsen (p.c., '44).

* HANKSITE, 1884

$9Na_2SO_4 \cdot 2NA_2CO_3 \cdot KCl$

Hexagonal. Prismatic, tabular. Vitreous luster. Color white. H. = 3-3½. G. = 2.562.

Fuses easily, giving a violet flame when seen through blue glass or the Merwin color screen. Easily soluble in water. Taste saline. Shows a slight effervescence when dropped into dilute hydrochloric acid. Barium chloride precipitates barium sulphate. Silver nitrate precipitates silver chloride.

Inyo County: 1, Reported from the borax fields of Death Valley by Hanks (17) p. 63.

Mono County: 1, Hanksite in minute crystals has been found associated with trona on crusted deposits in salt pools on the east side of Mono Lake, Murdoch (26), p. 358.

San Bernardino County: 1, Hanksite was discovered at Searles Lake, described and named by Hidden (1) pp. 238-241 (with analysis by Mackintosh, Hanks (17) p. 63. It was analyzed and the crystals described by E. S. Dana and Penfield (2) p. 136, and Pratt (1) p. 133. The mineral is strongly luminescent, Melhase (4) p. 4.

Analysis	SO_3	CO_2	Cl	Na_2O	K	Insol.	Ign.
Mackintosh	45.89	5.42	2.36	46.34	--	--	-- = 100.01%
Penfield	43.59	5.42	2.13	40.86	2.33	4.41	1.32 = 100.06%
Pratt	45.93	5.65	2.21	43.35	2.48	0.19	-- = 99.81%
	45.78	5.63	2.28	43.61	2.39	0.12	-- = 99.81%

HAUSMANNITE

Manganese oxide, Mn_3O_4

Tetragonal. Small pyramidal crystals, granular massive. Pyramidal cleavage. Submetallic luster. Color brownish black. Streak chestnut brown. H. = 5-5½. G. = 4.72-4.85.

Infusible. Dissolves in hydrochloric acid, yielding chlorine gas. Borax bead is amethystine or wine colored. Fused on platinum with sodium carbonate, gives deep blue-green fusion.

Hausmannite is not easily identified, and may well occur in many other places in the state than those which have been recorded.

Placer County: **1**, Hausmannite has been reported near Auburn, Fairbanks (1) p. 47.

Plumas County: **1**, Specimens of hausmannite have come from Meadow Valley, Miser and Fairchild (1) p. 6.

San Joaquin County: **1**, Found at the old Ladd mine, with bementite, W. W. Bradley (32) p. 98.

San Luis Obispo County: **1**, Hausmannite occurs as an alteration product of older manganese minerals at the Staneuch Ranch, Prefumo Canyon (sec. 6, T. 31 S., R. 12 E., M. D.) P. D. Trask et al. (4) p. 86. **2**, It is abundant in the ore of the Noble Electric Company deposit, associated with barite and native copper, Taliaferro and Hudson (3) p. 269.

Santa Clara County: **1**, It was abundant as crystals and subhedral grains in the manganese boulder at Alum Rock Park, A. F. Rogers (21) p. 444.

Stanislaus County: **1**, It occurs with bementite and other manganese minerals at the Buckeye mine (secs. 2, 3, T. 5 S., R. 5 E., M. D.) P. D. Trask et al. (4) p. 59.

Trinity County: **1**, It makes up 40-50 percent of the ore at the Blue Jay mine (NW¼ sec. 17, T. 26 N., R. 12 W., M. D.), and occurs in neighboring mines in the Mad River area, P. D. Trask et al. (4) p. 59.

HAÜYNE

See lazurite

HEAVY SPAR

See barite

HECTORITE

See montmorillonite

HEDENBERGITE

See pyroxene

HEDYPHANE

See bayldonite

HELIOTROPE

See quartz, chalcedony

HELVITE

A silicate of beryllium and manganese, with sulphur, $(Mn,Fe)_8Be_6Si_6O_{24}\cdot S_2$

Isometric. Crystals commonly tetrahedrons. Cleavage poor. Color honey yellow to yellowish brown. H. = 6-6.5. G. = 3.16-3.36. Fuses readily. Distinguished from yellow garnet by test with As_2O_3, which produces bright yellow arsenic sulphide.

San Diego County: **1**, The first discovery of this rare mineral is recorded from the Clark vein at Rincon, where it occurs in petalite-spodumene rock in small yellow grains and imperfect crystals, Murdoch (18) p. 198. **2**, Helvite is reported as very rare minute honey-colored tetrahedra in the Gem Star and Katerina mines, Pala, Jahns and Wright (5), p. 31.

HEMATITE—Red Ocher

Iron oxide, Fe_2O_3

Hexagonal-rhombohedral. Crystals, compact massive. lamellar, granular, micaceous, and earthy. Luster metallic, submetallic, or dull. Color black, red, brown. Streak red and reddish-brown. H. = 5½-6½. G. = 4.9-5.3.

Gradually acted on by strong acids; ammonia precipitates ferric hydrate. Becomes magnetic on heating. Gives little or no water in closed tube.

Hematite forms the universal red coloring matter of the rocks. It is commonly fine grained or amorphous, but occasionally occurs as flaky crystalline *specular hematite*. Much more rarely it may be in larger, well-formed crystals. Many of the magnetite ores in the state are partially changed to *martite,* a pseudomorph of hematite in the form of magnetite. Many low-grade "red ochre" deposits of hematite in the state have been mined for pigment rather than for iron. It is possible to list only the more important occurrences of this mineral. H. Wilson (1) in Bulletin 370 of the U. S. Bureau of Mines, gives a good summary of the iron pigment ores of California.

Fresno County: **1**, A large vein of hematite and magnetite is found at the Magnetic and other mines in the Minaret Mountains, Goldstone (1) p. 191.

Humboldt County: **1**, A large quantity of hematite boulders, derived from several large veins, occur on the ocean beach 4 miles south of Centerville, Lowell (1) p. 408. Laizure (3) p. 295, describes what appears to be this deposit. Ogle (1) p. 79, was unable to verify the occurrence, although a large isolated fragment of altered volcanic rock that is probably limonite not hematite, was found at the locality.

Imperial County: **1**, Shiny, mirrorlike plates of hematite are found in several veins in the Cargo Muchacho district, Henshaw (1) p. 185.

Inyo County: **1**, Specular hematite occurs in considerable amount at the Roper iron mine 7 miles east of Kearsarge Station, Tucker (11) p. 475. **2**, A considerable body of hematite is reported 5 miles south of Shepards Canyon, almost on the edge of Panamint Valley, Crawford (1) p. 326. **3**, Hematite of high grade occurs in the Millspaugh iron deposit, Argus Mountains. (T. 22 S., R. 42 E., M. D.), Tucker (36) p. 319.

Kern County: **1**, Specular hematite is found at Mount Breckenridge (sec. 4, T. 29 S., R. 31 E., M. D.), G. C. Brown (1) p. 516.

Lake County: **1**, Pseudomorphs after marcasite have been found at the Baker mine 6 miles from Lower Lake, A. F. Rogers (3) p. 18.

Lassen County: **1**, An extensive deposit of hematite is reported 5 miles south of Susanville, J. C. O'Brien (1) p. 79. **2**, Micaceous hematite is found at Mountain Meadows, S. M. B. (13680).

Mono County: **1**, Specular hematite is locally abundant in the andalusite mine of Champion Sillimanite Inc., A. Knopf (7) p. 551. **2**, The "red vein" in the Bodie mine was so called because of the bright red color produced by hematite, Whiting (1) p. 385.

Placer County: **1**, An important deposit, associated with magnetite, occurs at the Hotaling mine, 3½ miles west of Clipper Gap, Logan (4) p. 452.

Plumas County: Massive and specular hematite occur in moderate abundance at several localities: **1**, Crescent Mills, **2**, Mumfords Hill, **3**, Lights Canyon, Hanks (12) p. 229; **4**, with magnetite near the Diadem Lode, E. M. Boyle (2) p. 12; **5**, a large vein with magnetite near Moonlight, 11 miles north of Taylorsville, ibid. p. 36.

Riverside County: **1**, Considerable hematite has been formed by alteration of magnetite at Eagle Mountain (T. 4 S., R. 14 E., S. B.), Harder (6) p. 63, Powell (1) p. 481. **2**, Specular hematite with epidote is found in the Monte Negro district, Storms (4) p. 369.

San Bernardino County: **1**, At the Iron Age deposit, 6 miles east of Dale (sec. 29, T. 1 S., R. 13 E., S. B.) extensive deposits of hematite and magnetite occur, Harder and Rich (4) p. 237. **2**, Hematite-magnetite deposits, some of them rather sizeable, are found in the Kingston Mountains (T. 19 N., R. 11 E., S. B.) Tucker and Sampson (17) p. 335. **3**, At Iron Mountain (sec. 27, T. 6 N., R. 4 E., S. B.) Cloudman et al. (1) p. 819. **4**, Cave Canyon (sec. 12, T. 11 N., R. 7 E., S. B.) ibid. p. 818. **5**, Soft hematite occurs near Kelso (T. 10 N., R. 13 E., S. B.), C. C. Jones (2) p. 1889, Lamey (5) p. 87. **6**, Massive hematite occurs at the Tiefort Mountains deposit (sec. 22 ?, T. 14 N., R. 4 E., S.B.), Tucker (36) p. 319. **7**, Hematite is found with magnetite in the Old Dad Mountains (sec. 13, 14 ?, T. 12 N., R. 10 E., S.B.), Lamey (3) p. 61. **8**, Hematite and magnetite from the Iron Mountain and Iron King deposits, Silver Lake district (T. 15 N., R. 6, 7 E., S.B.), Lamey (2) p. 39. **9**, Hematite occurs with magnetite in the Iron Hat deposit, (T. 6 N., R. 14 E., S.B.), Lamey (6) p. 99. **10**, Hematite is found in the Ship Mountains deposit (T. 5 N., R. 15 E., S.B.), Lamey (7) p. 113. **11**, Crystals and rosettes of specular hematite occur in metamorphic rocks at the Verde Antique quarry 15 miles northeast of Victorville; **12**, at Globerson Iron mine, 7 miles southeast of Hodge; and **13**, about 3 miles north of Barstow, found with yellow serpentine, epidote, green garnet and actinolite. Bowen (1), p. 134, 135, 148.

San Luis Obispo County: **1**, An extensive deposit is found at the Harrington iron mine (T. 31 S., R. 11 E., M. D.), Franke (2) p. 423.

Shasta County: **1**, The Iron Mountain mine supplied a considerable amount of hematite to the smelter at Heroult, Hanks (12) p. 229.

Sierra County: **1**, Pure and abundant specular hematite was reported from Four Hills, 10 miles northeast of Downieville, J. R. Browne (4) p. 222.

Sonoma County: **1**, A large body of hematite was reported from the Hooper ranch, 5 miles north of Nobles, near the west fork of the Gualala River, W. W. Bradley (1) p. 322.

HEMIMORPHITE—Calamine

Zinc silicate, $Zn_4Si_2O_7(OH)_2 \cdot H_2O$

Orthorhombic. Hemimorphic crystals. Drusy masses, earthy. Cleavage perfect prismatic. Brittle. Vitreous luster. Color white; sometimes bluish or brown. Streak white. H. = 4½-5. G. = 3.4-3.5.

Fuses with difficulty. Mixed with sodium carbonate and reduced on charcoal, gives yellow coating of zinc. Yields some water in a closed tube. Soluble, gelatinizes.

Inyo County: **1**, A little hemimorphite has been found with willemite and smithsonite at the Ygnacio mine, Cerro Gordo, S. M. B. (8587), Siebenthal (1) p. 922. **2**, Occurs as colorless crusts with occasional crystals, at the Defiance mine, and in radial groups of crystals at the Christmas Gift mine, Darwin district, A. Knopf (4) p. 12, Murdoch and Webb (14) p. 324. **3**, Fine radial groups up to half an inch in diameter occur with wulfenite and chrysocolla from the Reward mine, 2 miles east of Manzanar Station, A. Knopf (5) p. 118.

Kern County: **1**, A specimen (1231) in the University of California collections at Berkeley is from the Jewett mine.

San Bernardino County: **1**, Hemimorphite is associated with smithsonite at the Cuticura mine, S. M. B. (11534). **2**, Crusts and radiating clusters of slender crystals are found in cavities of barite at the Lead Mountain mine, Murdoch and Webb (14) p. 327. **3**, It is reported from "Calico," E. S. Dana (5) p. 1097, but this may be questionable. **4**, It occurs with hydrozincite at the Carbonate mine (sec. 32, T. 15, 16 N., R. 14 E., S. B.), Tucker and Sampson (33) p. 128. Wiebelt (**1**), p. 1.

HESSITE

Silver telluride, Ag_2Te

Isometric. Generally in distorted octahedrons. Sometimes massive. Metallic luster. Color lead gray to steel gray. Streak dark gray to black. H. = 2½-3. G. = 8.31-8.45.

Easily reduced to a metallic button of silver when fused on charcoal, and yields a white coating of telluric oxide. Gives the tellurium reaction like tetradymite.

Hessite generally contains gold and often grades into petzite, so the two tellurides are apt to be together in mines. They occur in most mines where gold tellurides are found, often associated with sylvanite or calaverite.

Calaveras County: **1**, Hessite was found with melonite and native tellurium at the Stanislaus mine on Carson Hill, Genth (5) p. 311, Logan (16) p. 133. **2**, Hessite carrying some gold occurs in the Ford mine half a mile east of San Andreas, A. Knopf (11) p. 39.

El Dorado County: **1**, One float specimen was found in 1854 near Georgetown, W. P. Blake (6) p. 270, (7) p. 302, Hanks (12) p. 229. Another was found 5 years later with native gold and galena, W. P. Blake (6) p. 270. **2**, Hessite was reported to occur in the Barnes Eureka mine, 3 miles northeast of Shingle Springs (N. R.)

Mono County: **1**, Hessite was found in the upper workings of the Silverado mine, Patterson district, in the Sweetwater Range, Gianella (p. c. '37).

Nevada County: **1**, A specimen of soft gray hessite, with gold and sulphides, has come from the Nevada City mine, Lindgren (12) p. 117.

2, Small specks of hessite associated with petzite and naumannite were found in the Idaho-Maryland mine, C. F. Tolman (p. c. '36).

Shasta County: **1**, Hessite was found in the Shearer and Rattler mine, 3 miles from Redding, Irelan (4) p. 47.

Siskiyou County: **1**, A specimen of hessite in gold ore has come from the Scott Bar mine, 3 miles from the mouth of Scott River, S. M. B. (10637).

Tuolumne County: **1**, Very small crystals were found in the Reist mine, Whiskey Hill, Silliman (9) p. 9, Schrader et al. (1) p. 60. **2**, It occurred in the Bonanza and Jumper mines near Jamestown, S. M. B. (13617). **3**, Hessite was associated with petzite and coloradoite in the Norwegian mine, Hillebrand (3) p. 62.

HETEROSITE

See purpurite

HEULANDITE

Hydrous calcium, sodium, and aluminum silicate,
$(Ca,Na,K)_6Al_{10}(Al,Si)Si_{29}O_{80}\cdot 25H_2O$

Monoclinic. In platy crystals. One perfect cleavage. Brittle. Luster pearly and vitreous. Color white, red, brown. Streak white. H. = 3½-4. G. = 2.18-2.22.

Intumesces or boils when fused. Soluble in hydrochloric acid, without gelatinization. Gives water in a closed tube.

Heulandite is a zeolite usually formed as a secondary mineral in cavities and seams of basic volcanic rock, with stilbite, chabazite, and other zeolites.

Kern County: **1**, Heulandite occurs sparingly in amygdules in lava at Red Rock Canyon, associated with natrolite and analcite, Murdoch (p.c. '52).

Los Angeles County: **1**, Heulandite occurs with natrolite in vesicular basalts west of Cahuenga Pass, near Mulholland highway, Funk (1) p. 34. **2**, Neuerburg (1), p. 158 locality 9; the mineral occurs with ptilolite in "pillow" basalt. **3**, Colorless crystals in veins and cavities in basalt were found a quarter of a mile west of Acton, Murdoch and Webb (6) p. 352.

Plumas County: **1**, Abundant heulandite replacing feldspar was found at the Engels mine, Graton and McLaughlin (4) p. 18.

San Diego County: **1**, Occurs sparingly as pale-brown crystals with stilbite, A. F. Rogers (4) p. 214, and rather abundantly replacing spodumene, associated with petalite, Murdoch (18) p. 198, both in the Rincon area. **2**, Occurs sparingly in buff-colored tabular crystals at Pala, in the gem pegmatites, Jahns and Wright (5), p. 42.

HIDDENITE

See spodumene

HILLEBRANDITE

See foshagite

HISINGERITE

A hydrated ferric silicate of doubtful composition
Perhaps not a definite mineral

Amorphous, color black to brownish. Streak yellowish brown. H. = 3. G. = 2.5-3.0. Luster greasy.

Sonoma County: **1,** Thin brown colloform crusts of hisingerite coating tridymite have been found in vesicles of augite andesite, NE¼ sec. 10, T. 7 N., R. 7 W., M. D., Rose (p.c. '50).

HOHMANNITE

Basic iron sulphate, $Fe_2O_3 \cdot 2SO_3 \cdot 8H_2O$

Triclinic. Crystalline aggregates, clusters or prismatic crystals. One perfect, two less perfect cleavages. Luster vitreous. Color orange to dark brown. H. = 3. G. = 2.2.

Fusible. Heated in a closed tube turns dark and gives water which has an acid reaction. Practically insoluble in cold water but decomposed by hot water. Easily soluble in hydrochloric acid.

Ungemach (2) p. 115, shows that *castanite* is the same as hohmannite.

Napa County: **1,** Crystals of hohmannite, identified as castanite in brecciated opalite, have been described by A. F. Rogers (35) p. 396 from the Redington (Boston) quicksilver mine at Knoxville. This occurrence is referred to also by Bandy (1) p. 534.

HORNBLENDE

See amphibole

HORN SILVER

See cerargyrite

HOWLITE

Hydrous calcium silico-borate, $H_5Ca_2B_5SiO_{14}$

Monoclinic. Round nodules, massive, chalky. Dull luster. Color white. H. = 1-3½. G. = 2.5.

Fuses easily and colors the flame green. Easily soluble and precipitates silica. Calcium is precipitated with ammonium oxalate from a weak hydrochloric-acid solution. Yields water in a closed tube. Gives the boron reaction with turmeric paper.

Howlite is an associate of the other borates, but owing to the silica present it is not utilized, although it contains a large amount of boric oxide. It has been mistaken for pandermite at several borate localities in California.

Inyo County: **1,** White micaceous masses of howlite have been found in Gower Gulch near Ryan, Larsen (11) p. 87.

Kern County: **1,** A small nodular mass of howlite was found on the 955-foot level of the Western borax mine at Kramer, H. S. Gale (16) p. 332.

Los Angeles County: **1,** Cauliflower-like masses of howlite are abundant in the colemanite deposit in Tick Canyon, Eakle (10) p. 187, Foshag (7) p. 204, Armstrong and Van Amringe (1).

San Bernardino County: **1,** Howlite occurs abundantly as chalky white seams and nodules in the borate beds at Calico, and occasionally as delicate thin platy crystals encrusting celestite crystals, Giles (2) p. 353, Foshag (9) p. 208.

Ventura County: **1,** Masses of howlite, originally assumed to be priceite (pandermite) were found abundantly at the Russell and other borax mines north of Lockwood Valley, H. S. Gale (11) p. 442, Murdoch (p.c. '45).

HUEBNERITE

See wolframite

HUREAULITE

Hydrous manganese phosphate, $H_2Mn_5(PO_4)_4 \cdot 4H_2O$

Monoclinic. In groups of short prisms. Massive, compact. One cleavage distinct. Color orange red, rose, and nearly colorless. H. = 5. G. = 3.18.

Easily fusible. The nitric-acid solution gives the phosphate reaction on addition to ammonium molybdate. A blue-green bead of manganese is obtained when hureaulite is fused with sodium carbonate. Yields water in a closed tube. Soluble in acid.

San Diego County: **1**, Found at the Stewart mine, Pala, associated with lithiophilite and other phosphates, Schaller (29) p. 145. Minute well-developed crystals from this locality were described by Murdoch (16) p. 19. Palaite is now considered to be identical with hureaulite, Schaller (p.c., '46).

HYACINTH

See garnet

HYALITE

See opal

HYALOPHANE

See feldspar

HYBLITE

See thorogummite

HYDROBORACITE

Hydrous calcium and magnesium borate, $CaMgB_6O_{11} \cdot 6H_2O$

Monoclinic. Crystals prismatic. In fibrous masses. Cleavages: two perfect. Color white. H. = 2. G. = 2.

Fuses easily to a clear glass and colors the flame green. Gives much water in a closed tube.

Inyo County: **1**, Prismatic or needle-like crystals have been found near Ryan, in the Mount Blanco district of Death Valley, Foshag (10) p. 9, Schaller (43) p. 256, and measured by Schaller (43) p. 256.

Ventura County: **1**, Hydroboracite was reported in 1899 from the Frazier borax mine, S. M. B. (15347), (15446).

HYDROMAGNESITE

Hydrous basic magnesium carbonate, $3MgCO_3 \cdot Mg(OH)_2 \cdot 3H_2O$

Monoclinic. Crystals small, tufted. Generally massive, chalky crusts. One perfect cleavage; one distinct. Vitreous silky to dull luster. Color and streak white. H. = $3\frac{1}{2}$. G. = 2.16.

B.B. infusible. Effervesces easily in dilute acids.

Hydromagnesite is formed by the alteration of serpentine and other magnesian rocks.

Alameda County: **1**, Narrow veins in serpentine, at the south slope of Sugarloaf Butte, show minute crystals of hydromagnesite, Kramm (1) p. 344, A. F. Rogers (24) p. 38. **2**, Seams of hydromagnesite in serpentine, with calcite and aragonite, occur at Arroyo Mocho, 20 miles southeast of Livermore, A. F. Rogers (24) p. 46. **3**, Considerable hydromagnesite occurs at the Devil's Hole (sec. 3, T. 5 S., R. 3 E., M. D.), Dolbear (8) p. 238. **4**, Massive white hydromagnesite has been reported near Pleasanton, S. M. B. (8217).

Colusa County: **1**, It occurs abundantly at Sulphur Creek, as a chalk-like alteration product of serpentine, Kramm (1) p. 344, A. F.

Rogers (24) p. 47. **2**, It occurs with thomsonite and datolite near Wilbur Springs, Pabst (p.c. '45).

Fresno County: **1**, Minute crystals occur in seams of serpentine east of Condon Peak, Watters (p.c. '51).

Inyo County: **1**, It was reported as chalky or mealy crusts along the Amargosa River, G. E. Bailey (2) p. 102.

Marin County: **1**, It is found at Bolinas (T. 1 N., R. 8 W., M. D.), S. M. B. (15763).

Merced County: **1**, A specimen of hydromagnesite in the Stanford University collections came from the Bald Eagle mine, near Gustine.

Napa County: **1**, Hydromagnesite mixed with quartz is reported from Phillips Springs, Larsen (3) p. 3.

Riverside County: **1**, It occurs as an alteration of brucite in the predazzite rock of the Wet Weather quarry at Crestmore, A. F. Rogers (19) p. 583, (31) p. 466. Measurable crystals have been found at Crestmore and x-ray determination of the unit cell made from these, Murdoch (24) p. 1465, (29) p. 24. **2**, Hydromagnesite occurs with periclase and brucite in the crystalline limestone of the Jensen quarry, MacKevett (1), p. 6.

San Benito County: **1**, Hydromagnesite occurs in powdery white balls on Larious Creek, on the slope of Sampson Peak (W$\frac{1}{2}$ sec. 35, T. 17 S., R. 11 E., M. D.), H. S. Gale (12) p. 508. **2**, It was reported by J. D. Whitney (7) p. 59, between the San Carlos and New Idria mines. **3**, Minute crystals have been found in seams in serpentine near the benitoite locality, A. F. Rogers (24) p. 46.

San Bernardino County: **1**, Hydromagnesite altered from brucite is reported from Lucerne valley (SE$\frac{1}{4}$ SE$\frac{1}{4}$ sec. 15, T. 6 N., R. 1 W., S. B.), Ian Campbell (1), p. 3.

San Diego County: **1**, Minute hollow spheres of hydromagnesite occur in the pyrrhotite ore of the Friday mine, Creasey (1) p. 27.

San Francisco County: **1**, Hydromagnesite occurs as botryoidal masses and veins 3 to 4 inches wide in the serpentines at Fort Point, Eakle (1) p. 316, Mining and Scientific Press (19) p. 28. **2**, Specimens have come from Market Street near Guerrero, S. M. B. (1320), (1321).

San Luis Obispo County: **1**, Small veins were found near Port Harford (Port San Luis), S. M. B. (1175).

San Mateo County: **1**, Small white patches in serpentine occur near Searsville Lake, A. F. Rogers (24) p. 46.

Santa Barbara County: **1**, A specimen has come from near Santa Barbara, S. M. B. (13699). **2**, Massive hydromagnesite occurs on Figueroa Mountain, Woodhouse (p.c. '45).

Santa Clara County: **1**, Spherical nodules of finely crystalline hydromagnesite up to 4 centimeters in diameter, were found in serpentine at the lower end of Alum Rock Canyon, A. F. Rogers (24) p. 46. **2**, Microcrystalline masses come from the lower end of Calaveras Valley, ibid. p. 46.

Sonoma County: **1**, Chalky balls of hydromagnesite have been found in nickeliferous serpentine near Cloverdale, W. W. Bradley (29) p. 222.

Stanislaus County: **1**, A considerable quantity of hydromagnesite has been reported from Red Mountain, Dolbear (8) p. 238. **2**, It has been found on the Pramberger property 14 miles west of Patterson, Laizure (9) p. 57.

HYDROTHORITE

See thorogummite

HYDROTROILITE

Probably $FeS \cdot nH_2O$

Amorphous, usually black, finely divided material. Palache et al. (10) p. 236, suggest validity of the species is doubtful.

Riverside County: **1**, Hydrotroilite has been found in the new city quarry, Victoria Avenue, Riverside, Laudermilk and Woodford (5) p. 418. **2**, It occurs rather abundantly in the contact zone of the Lone Star quarry, Crestmore, Woodford et al. (10) p. 366.

San Bernardino County: **1**, It has been found at the lapis lazuli occurrence in Cascade Canyon (SW¼ sec. 31, T. 2 N., R. 7 W., S. B.), Laudermilk and Woodford (5) p. 418.

HYDROZINCITE

Basic zinc carbonate, $2ZnCO_3 \cdot 3Zn(OH)_2$

Monoclinic. Minute crystals, thin blades parallel to one perfect cleavage. Usually massive or earthy, as incrustations. Dull luster. Color white, grayish, yellowish. H. =2-2½. G. = 3.58-3.8.

B.B. Infusible. Intensely heated on charcoal with cobalt nitrate, will assume green color of zinc. Soluble with effervescence in dilute acid. Gives water in closed tube.

Hydrozincite is of secondary origin, formed usually by the alteration of sphalerite.

Inyo County: **1**, Hydrozincite occurs associated with hemimorphite, aurichalcite, and smithsonite at the Cerro Gordo mine, A. F. Rogers (7) p. 374, A. Knopf (5) p. 106. **2**, Colorless or white blade-like crystals associated with linarite occur at the Defiance mine, Darwin district, Murdoch and Webb (14) p. 324. **3**, Associated with ores at Minietta and Modoc mines, Argus Range. Woodhouse (p.c. '54).

San Bernardino County: **1**, It is found with smithsonite and cerussite, at the Carbonate King mine, 14 miles north of Cima (sec. 32, T. 16 N., R. 14 E., S. B.), Tucker and Sampson (33) p. 128. **2**, It is found at Dale Lake ibid. (34) p. 479.

HYPERSTHENE

See pyroxene

ICE

See water

ICELAND SPAR

See calcite

* IDDINGSITE, 1893

Hydrous magnesium and iron silicate, $MgO \cdot Fe_2O_3 \cdot 3SiO_2 \cdot 4H_2O$

Orthorhombic. Lamellar crystals. Cleavage, one perfect. Bronze luster. Color chestnut brown to yellowish green. H. = 2½-3. G. = 2.84.

Infusible. Becomes magnetic when heated. Decomposed by hydrochloric acid.

Alpine County: **1**, Iddingsite occurs abundantly as bright orange-yellow pseudomorphs after olivine phenocrysts, in the West Dardanelles flow, west of Dardanelle Cone on the border of Tuolumne County, F. L. Ransome (7) p. 52.

Inyo County: **1**, Iddingsite is found in the basalts about one kilometer southeast from the Russell borax mine, Mount Blanco district, Foshag (10) p. 10.

Kern County: **1**, Iddingsite occurs rather abundantly as pseudomorphs after olivine in basalt in the Bartolas country northeast of Isabella, Webb (9) p. 324. **2**, Iddingsite occurs as red-brown patches in the zeolitic lavas of Red Rock Canyon, Murdoch (p.c. '51).

Los Angeles County: **1**, Iddingsite has been found in the Santa Monica Mountains, Larsen (11) p. 91.

Monterey County: **1**, Iddingsite has been found as a prominent constituent of a basic rock called carmeloïte by Lawson. He recognized the mineral as new, and described it, Lawson (1) p. 31. It has been further discussed by Ross and Shannon (1) p. 13.

San Bernardino County: **1**, Iddingsite has been erroneously reported from Siberia Crater, W. W. Bradley (30) p. 207, but all the material from here is olivine stained red by iron oxide, Foshag, Murdoch (p.c. '45).

Siskiyou County: **1**, Yellow iddingsite has been doubtfully reported from the Hayes group (T. 44 N., R. 8 W., M. D.), W. W. Bradley (30) p. 128. **2**, Similarly from near Seiad Valley (T. 47 N., R. 11 W., M. D.), W. W. Bradley (28) p. 343.

Trinity County: **1**, Iddingsite is associated with olivine from this county, W. W. Bradley (29) p. 106.

IDOCRASE

See vesuvianite

IDRIALITE

See aragotite

ILMENITE—Menaccanite

Oxide of iron and titanium, $FeTiO_3$

Hexagonal-rhombohedral. Plates, massive, in rounded pebbles and grains. Submetallic luster. Color black. Streak dark brown to black. H. = 5-6. G. = 4.5-5.

Magnetism usually increased by heating. If ilmenite is fused with sodium carbonate and the flux dissolved in hydrochloric acid, the solution turns violet when reduced with metallic tin.

Ilmenite is very similar in appearance to magnetite, with which it is often confused. It is a common constituent of igneous rocks, and is frequently present in small grains in beach and river sands, accompanied by magnetite and other heavy minerals. In this form it is very widespread throughout the state, and only the most important occurrences can be noted.

Alpine County: **1**, Platy and massive ilmenite are found with lazulite and andalusite 10 miles south-southwest of Markleeville, Woodhouse (p. c. '45).

El Dorado County: **1**, Ilmenite occurs in the placer sands near Georgetown, and from this locality, W. P. Blake (7) p. 303, records the occurrence of beautiful complex crystals, one as much as an inch across, with brilliant faces. This occurrence is quoted by Hanks (12) p. 260, Kunz (24) p. 105.

Kern County: **1**, Crystals up to 2 inches across have been found at the Greenback copper mine, Turner (23) p. 548.

Los Angeles County: **1**, A number of deposits of varying sizes, of ilmenite-magnetite intergrown microscopically, occur in anorthosite in the San Gabriel Mountains (T. 3, 4 N., R. 12, 13, 14 W., S. B.), Tucker (13) p. 296. **2**, Ilmenite sands have occurred in commercial quantity at Redondo, Youngman (1) p. 20.

Madera County: **1**, Large platy masses of ilmenite are found with pyrophyllite and quartz at the low pass immediately east of the junction of Bench Creek and North Fork, San Joaquin River, Erwin (1) p. 29. **2**, Ilmenite is found as platy masses with epidote on Rush Creek Divide, west of Agnew Pass, ibid. p. 24. **3**, Fine specimens have come from Taylors Ranch, near Buchanan, Hanks (12) p. 260.

Mono County: **1**, It occurs very sparingly at the great andalusite deposit in the White Mountains, 7 miles east of Mocalno, Woodhouse (4) p. 4.

Plumas County: **1**, Small amounts, intergrown with magnetite and hematite, occur at the Engels mine, A. Knopf and Anderson (12) p. 27.

San Benito County: **1**, Rhombohedral basal plate crystals 2-3 mm thick and 7 mm broad were found with magnetite octahedrons in dark metamorphic rock near the Gem Mine by Watters. (Crippen p.c. '50.)

San Bernardino County: **1**, Ilmenite in thin plates, 1-5 mm thick, and extending up to 3 feet, occur in radial arrangement in quartz at the Pomona Tile quarry, on the road between Old Woman Spring and Yucca Valley, Hewett & Glass (3) p. 1048. It is associated here with allanite, monazite and euxenite.

Santa Cruz County: **1**, Layers of black sand up to 6 inches in thickness occur at Aptos. They are largely magnetite and ilmenite, Hess (19) p. 463.

ILSEMANNITE

Molybdenum compound, formula uncertain, perhaps $Mo_3O_8 \cdot nH_2O$

Cryptocrystalline. Color blue black to black. Soluble in water.

Inyo County: **1**, Reported as a pigment in copiapite, in molybdenite deposit near the north end of Death Valley, Palache et al. (10) p. 604.

Shasta County: **1**, Blue zones surrounding molybdenite in quartz, and associated molybdite, 4 miles west of Gibson, have been tentatively identified as ilsemannite, Cook (1) p. 50.

ILVAITE

Calcium and iron silicate, $Ca(Fe,Mn)_2Fe'''(SiO_4)_2(OH)$

Orthorhombic. In long prisms vertically striated. Columnar or compact massive. Two cleavages distinct. Brittle. Sub-metallic luster. Color and streak grayish black. H. = $5\frac{1}{2}$-6. G. = 3.99-4.05.

Easily fusible. Becomes magnetic after heating. Gelatinizes with hydrochloric acid.

Fresno County: **1**, Slender black crystals of ilvaite have been reported in metamorphic limestone in the Twin Lakes area, Chesterman (p.c. '51).

Shasta County: **1**, Thin bands and long prisms of ilvaite occur on both sides of a narrow dike cutting limestone on Potter Creek, near Baird. The crystals occur on quartz and hedenbergite, and have been described by Prescott (1) p. 14. **2**, Small amounts of ilvaite have been found in the ore of the Shasta and California iron ore deposit (sec. 26, T. 34 N., R. 4 W., M.D.), Lamey (9) p. 149.

Sonoma County: **1**, A boulder of quartzite, colored black with ilvaite was found near Petaluma (N. R.).

INDERITE

Hydrous magnesium borate $Mg_2B_6O_{11}\cdot 15H_2O$

Triclinic. Fine prismatic needles and nodules. Luster somewhat greasy, but on cleavage faces pearly. One perfect cleavage and another good. H. = 3. G. = 1.86.

Easily soluble in warm HCl. Readily fusible to a white bead. Gives off slightly alkaline water in closed tube.

Kern County: **1**, A few grains of inderite were identified by Dr. Clifford Frondel, in a specimen from a drill core from the Baker mine at Boron, in the Kramer district, Mineral Notes and News (3) p. 12. This is the first Californian, and second American, occurrence of this mineral, which has been found elsewhere only in the Inder region of West Kazakstan.

INESITE

Hydrous manganese and calcium silicate, $(Mn,Ca)_3Si_3O_8\cdot(OH)_2$

Triclinic. Prismatic crystals, sometimes fibrous radiating or spherulitic. One cleavage perfect. Vitreous luster. Color rose red. H. = 6. G. = 3.03.

Fusible. Decomposed by hydrochloric acid.

Inesite is a common associate of psilomelane in several of the mines of this state.

Alameda County: **1**, Rose-red veins of inesite with bementite intersect the rhodochrosite at the Newhall (Bailey) mine, 10 miles southeast of Livermore, on the Arroyo Mocho (N. R.).

Mendocino County; **1**, Inesite veins with associated bementite and neotocite occurred in the rhodochrosite at Impassable Rock, Mount Sanhedrin, about 8 miles from Hearst (N. R.).

San Joaquin County: **1**, Inesite was common at the old Ladd mine (N. R.).

Stanislaus County: **1**, Gray rhodochrosite on the Cummings lease is intersected by veinlets of rose-red inesite with bementite. Crystals from this occurrence have been described (N. R.).

Trinity County: **1**, Veins of silky radiating crystals of inesite, up to a quarter of an inch in diameter occur with rhodochrosite and bementite at the Hale Creek mine (NW¼ sec. 23, T. 1 S., R. 6 E., H.) P. D. Trask et al. (4) p. 59.

INFUSORIAL EARTH

See opal

* INYOITE, 1914

Hydrous calcium borate, $Ca_2B_6O_{11}\cdot 13H_2O$

Monoclinic. In large glassy transparent crystals. Cleavage basal. Brittle. H. = 2. G. = 1.875.

Decrepitates on fusing and intumesces, giving the green boron flame. Easily soluble in acids. Gives water in a closed tube.

Inyo County: **1**, Inyoite was found with meyerhofferite and colemanite in Corkscrew Canyon, Mount Blanco region, Death Valley, and described and named by Schaller (33) p. 35. It is commonly altered to meyerhofferite, but occasionally a clear crystal may be found.

Analysis

CaO	B_2O_3	H_2O under 110°	H_2O above 110°
20.5	*[37.2]*	26.1	16.2 = 100%

IOLITE

See cordierite

* IONITE, 1878

A hydrocarbon containing about 50 percent water. Earthy. Color brownish yellow. G. = 0.90.

Amador County: **1**, Ionite was found in an argillaceous lignite in thin seams in Ione Valley, Purnell (1) p. 184.

IRIDIUM

(Probably iridosmine)

Mendocino County: **1**, Reported with platinum, and gold, from Anderson Valley placer along Navarro River, Hanks (12), p. 310.

IRIDOSMINE—Siserskite

Native alloy of iridium and osmium, (Ir, Os)

Hexagonal-rhombohedral. Generally in grains. Cleavage perfect basal. Metallic luster. Color tin-white to light steel-gray. H. = 6.7. G. = 19.3-21.12.

The name *iridosmine* is applied to those mixtures with Ir>Os, and *siserskite* to those with Os>Ir. The alloy of these two metals is frequently found in the gold placers, associated with platinum, and analysis shows the presence of the rarer elements rhodium and ruthenium, Deville and Debray (1) p. 449. Crystals were measured by Gladhill (1) p. 42.

Butte County: **1**, Iridosmine was found in the gold sands at Cherokee, Silliman (12) p. 132.

Del Norte or Humboldt County: **1**, The largest nugget of iridosmine found in California came from the lower Klamath River, Hittel (2) p. 61. It weighed 1¼ ounces.

Humboldt County: **1**, Iridosmine has been reported from China Flat, Horton (1) p. 874. **2**, With platinum from Humboldt Bay, Richthofen (3) p. 46.

Placer County: **1**, Found on the North Fork, American River, Genth (1) p. 113.

Shasta County: **1**, Occurs in placer concentrates at the headwaters of Cottonwood Creek, Mining and Scientific Press, (28) p. 209.

Trinity County: **1**, A 27-ounce lot of nuggets of platinum and iridosmine from near Junction City, Trinity River, included one iridosmine nugget of ¾-ounce weight, Horton (1) p. 874.

Tuolumne County: **1**, Six-sided scales of siserskite were found by Genth (1) p. 113, (2) p. 209, (2) p. 247, after dissolving away the platinum and gold of concentrates from near Stanislaus.

IRON

Native iron, Fe

Isometric. Generally massive. Malleable. Metallic luster. Color steel gray to iron black. H. = 4-5. G. = 7.3-7.8.

Strong magnetism and malleability distinguish it from all other iron minerals.

Terrestrial iron, which sometimes occurs in basaltic rocks, has not so far been found in California. The only iron here is meteoritic, and to date 13 falls have been recorded. It is customary to locate these falls by means of coordinate numbers which give the longitude and the latitude to the nearest tenth of a degree. For example, 1181,349 is the coordinate designation of a fall whose longitude is 118.1° W, and whose latitude is 34.9° N. Somewhat less than half the known falls are wholly or mainly iron, which invariably carries 5 to 30 percent nickel, usually a little cobalt, and other minor elements. Others are the stony meteorites, which usually carry some free iron, also nickeliferous, and which are largely composed of silicates of iron and magnesium.

Butte County: **1**, A 54-pound meteorite was found near Oroville, coord. 1216,395, in 1893, Farrington (2) p. 16. According to Farrington, it may be in the California State Division of Mines Exhibit labeled as from Canyon Diablo.

El Dorado County: **1**, The Shingle Springs meteorite was discovered in 1869, coord. 1209,386, half a mile from Shingle Springs. It is a nickel-rich ataxite weighing 85 pounds, C. U. Shepard (2) p. 438, Silliman (11) p. 18, Farrington (2) p. 412.

Imperial County: **1**, A small stony meteorite, chondrite, was found in 1908, at coord. 1156,329, near Imperial, and is now in the National Museum in Washington, E. P. Henderson (p.c., '46).

Inyo County: **1**, About 22 miles northeast of Big Pine, coord. 1180,374 (approx.) a medium octahedrite weighing 425 pounds was found in 1913, and described by G. P. Merrill (3) p. 5.

Kern County: **1**, A stony meteorite, originally weighing about 80 pounds, was found in the San Emigdio Mountains in 1887, coord. 1160,350 (approx.). It was put through the crusher before its character was recognized, but it was definitely determined as a chondrite by G. P. Merrill (1) p. 49, (2) p. 161. It was analyzed by Whitfield (3) p. 114. Another reference to this meteorite is Reeds (1) p. 618. **2**, In November 1940, an aerolite weighing 850 grams was discovered in Rosamond Dry Lake, W. T. Whitney (1) p. 387, (1) p. 291, coord. 1181,349. **3**, **4**, Finds of 3 stones were made in Muroc Dry Lake in 1936, Nininger and Cleminshaw (2) p. 273, p. 23. Two stones were found close together, and another at a little distance. They are all aerolites with nickel iron and have been designated as Muroc Dry Lake meteorites, weights 115 and 58 grams, and Muroc meteorite, weight 18.4 grams. Coord. 1178,349. They may represent separate falls, but according to Leonard (p.c., '46) they are probably a single fall.

Los Angeles County: **1**, The Neenach stony (aerolite) meteorite (coord. +1185,348) was found by Mr. Elden Snyder in Antelope Valley in 1948. The stone resides in the collections of the University of California, Santa Barbara College, as a gift from Mr. Snyder, Leonard (3) p. 28, Anon. (24) p. 80.

Modoc County: **1**, The largest known meteorite of California and the fourth largest in the United States was found October 13, 1938, near Goose Lake, coord. 1205,420. It is a siderite weighing 2573 pounds (1167 kilograms), and is probably an old fall, Leonard (1) p. 508, (2) p. 3, Linsley (2) p. 308. The specimen now is in the U. S. National Museum, Washington, D. C.

San Bernardino County: **1**, An aerolite, gray chondrite, was found June 10, 1929, half a mile north of Valley Wells, coord. 1157,355, Reeds

(1) pp. 633, 634, Coulson (1) p. 220. This is clearly the same fall as that called Windmill Station, recorded by Linsley (1) p. 472. Four pieces were found, with weights 10.5, 13.5, 24, 81.9 grams. **2**, A siderite (medium octahedrite) was found in 1880, 8 miles from Ivanpah, coord. 1153,354. It weighed about 128 pounds and carried about 4½ percent nickel, C. U. Shepard (4) p. 381. It was analyzed by him, and also by Cohen and Weinschenk (1) pp. 131-165; and Cohen (2) p. 149. It is now in the State Division of Mines Exhibit (2339). **3**, An iron meteorite weighing 1524 grams (about 3 pounds), was found in 1899 lying on the surface of a quartz outcrop on the south slope of the Bullion Range, near Surprise Springs, coord. 1159,342, Cohen (3) pp. 29-33, Farrington (2) p. 430.

Trinity County: **1**, An oval-shaped piece of meteoritic iron weighing about 19 pounds was found in 1875 on a small tributary of Trinity River, 3 miles northeast of Canyon City, coord. 1231,409, C. U. Shepard (5) p. 469, Ward (1) p. 383.

IRON ALUM

See halotrichite

IRON PYRITES

See pyrite

JADEITE

See pyroxene

JAMESONITE

Lead antimony sulphide, $Pb_4FeSb_6S_{14}$

Monoclinic. In acicular and capillary crystals. Generally fibrous massive. Cleavage perfect basal. Brittle. Metallic luster. Color lead gray. Streak grayish black. H. = 2-3. G. = 5.5-6.0.

The yellow and white coating on charcoal of lead and antimony oxides, and odor of sulphur, are obtained by heating. Dissolved in nitric acid, the lead goes into solution, while the antimony is precipitated as an oxide.

Calaveras County: **1**, Jamesonite is recorded from Mokelumne Hill, Hanks (12) p. 244.

Inyo County: **1**, Compact massive specimens of jamesonite associated with argentiferous galena have come from the Cerro Gordo mine (N.R.).

Kern County: **1**, Jamesonite or bournonite is reported from Soledad Mountain, Mojave district, with cerargyrite and argentite in the gold ores, Schroter (1) p. 185.

Napa County: **1**, Delicate capillary crystals of jamesonite ("feather ore") were found with cinnabar at the Manhattan mine S.M.B. (15530).

Sierra County: **1**, Small needles and clusters of jamesonite occur in vugs in quartz at the Rainbow and Plumbago mines, Alleghany district, Ferguson and Gannett (4) p. 30, (6) p. 49.

JAROSITE

Hydrous potassium and iron sulphate, $K_2O \cdot 3Fe_2O_3 \cdot 4SO_3 \cdot 6H_2O$

Hexagonal-rhombohedral. Small platy crystals; fibrous, granular. Basal cleavage distinct. Brittle. Vitreous luster. Color yellowish brown. Streak yellow. H. = 2½-3½. G. = 3.15-3.26.

Only partially soluble in cold water, otherwise like coquimbite in its reactions.

Imperial County: **1**, Crusts of small brown crystals of jarosite are found at the American Girl mine, Cargo Muchacho Mountains, Murdoch (p.c. '49).

Inyo County: **1**, Jarosite is abundant in light-colored mica schists in the Wild Rose Canyon district, D. E. White (1) p. 318. **2**, Also in veins cutting across most other minerals, in igneous rocks of the contact zone, Darwin district, Kelley (4) p. 542.

Lake County: **1**, Jarosite occurs associated with copiapite and epsomite at Sulphur Bank, Everhart (1) p. 139.

Merced County: **1**, Yellow-brown colloform crusts of jarosite have been found in a few antimony veins of the Stayton district in this and San Benito Counties, E. H. Bailey and Myers (4) p. 418. **2**, Jarosite in microscopic grains, occurs abundantly in glauconite-jarosite sandstone, sec. 35, T. 11 S., R. 10 E., M.D., Briggs (1) p. 902.

Mono County: **1**, Jarosite has been reported by Hulin (p.c., '36) from the Blind Spring Hill district, near Benton. **2**, Some jarosite occurs with alunite and limonite at the great andalusite deposit 7 miles east of Mocalno, White Mountains, Tucker and Sampson (4) p. 461, Woodhouse (2) p. 4.

San Benito County: **1**, A. F. Rogers (7) p. 376, has found measurable jarosite crystals at the New Idria quicksilver mine. **2**, Jarosite was found in the Stayton district (cf. Merced County), E. H. Bailey and Myers (4) p. 418.

San Bernardino County: **1**, Jarosite is rather abundant among the sulphates at the "sulphur hole," just below the borax mines in the Calico Hills, Foshag (19) p. 352. **2**, Jarosite occurs sparingly in the Keystone mine (SE$\frac{1}{4}$ sec. 18, T. 7 N., R. 4 W., S.B.) in Stoddard Mountain, 14 miles northeast of Victorville, in irregular microscopic crystals in clusters and aggregates, Hutton and Bowen (2) pp. 556-561.

Santa Clara County: **1**, Jarosite is present in the New Almaden mine. Irelan (4) p. 47.

JASPER

See quartz, chalcedony

JEFFERISITE

Hydrous magnesium, iron, and aluminum silicate,
$10(Mg,Fe)O \cdot 4(Al,Fe)_2O_3 \cdot 10SiO_2 \cdot 7H_2O$

Broad plates, small scales. Cleavage perfect basal. Pearly luster. Color dark yellowish brown. H. = $1\frac{1}{2}$. G. = 2.30.

Rather difficult to fuse, but exfoliates when heated. Soluble in hydrochloric acid, but without gelatinization. Gives water in a closed tube.

Jefferisite is a hydrated mica belonging to the vermiculites.

Lassen County: **1**, Large brown plates of jefferisite have been found at Susanville, Hanks (12) p. 244, S. M. B. (2126).

Mendocino County: **1**, A specimen of jefferisite, S. M. B. (13997) has come from this county.

Tulare County: **1**, Hanks (12) p. 244, reports jefferisite from the county—no precise location. S. M. B. (4911).

JEZEKITE

Basic sodium, calcium, aluminum fluophosphate, $Na_4CaAl_2(PO_4)_2(OH)_2F_2O$(?)

Monoclinic. Prismatic and tabular habit. Radial fibrous or columnar crusts or aggregates. Cleavage pinacoidal, perfect. H. = 4-$4\frac{1}{2}$. G. = 2.94.

Luster vitreous and pearly on cleavage faces. Colorless to white and pale rose. Streak white. Translucent.

B.B. infusible. Incompletely decomposed by cold H_2SO_4 or aqua regia, completely so in hot H_2SO_4.

San Diego County: Massive amblygonite in the Stewart mine at Pala carries thin veins with minute colorless grains of jezekite, associated with glassy wardite and fibrous carbonate-apatite, Murdoch (p.c. '53).

* JOAQUINITE, 1909

Sodium, barium, and iron titano-silicate, $NaBa(Ti,Fe)_3Si_4O_{15}$

Orthorhombic. In minute crystals. Honey yellow to brown. H. = $5\frac{1}{2}$-6. G. = 3.89.

Fuses with intumescence to brown glass. Insoluble.

San Benito County: 1, Small brown crystals of joaquinite are found associated with benitoite and neptunite at the benitoite gem mine (sec. 25, T. 18 S., R. 12 E., M. D.), and were described and named by Louderbach and Blasdale (5) p. 376, Palache and Foshag (7) p. 308.

Analysis (by Foshag)

SiO_2	TiO_2	FeO	BaO	MgO	Na_2O
36.4	30.5	3.5	24.7	0.3	4.6

† JURUPAITE, 1921

See xonotlite

KALINITE

See potash alum

KÄMMERERITE

See chlorite, penninite

KAOLINITE

Hydrous aluminum silicate, $Al_4Si_4O_{10}(OH)_8$

Monoclinic. Occurs occasionally in scales and plates but is generally massive, earthy, clay-like. Cleavage perfect basal. Flexible. Pearly to dull luster. Color white, yellow, red, brown. H. = 2-$2\frac{1}{2}$. G. = 2.6.

Pure clays are infusible and insoluble, but some not being pure kaolinite, will fuse to a glass and are slightly soluble. Most will turn a blue color when heated intensely after moistening with cobalt nitrate. Gives water in a closed tube.

Miloschite is a chromian kaolinite. *Lithomarge* is a compact variety.

Kaolinite forms the base of most clays. It is formed by the alteration of rocks containing aluminum silicates, especially the feldspars, and most good clays come from the alteration of potash feldspar. The mineral is practically universal in occurrence, and only those localities which are of considerable importance are recorded. Common brick clay is found in every county. Detailed information as to deposits may be found in Dietrich's *Clay Resources and Ceramic Industry of California*, Bulletin 99 of the State Mining Bureau, and the references below are to this authority, unless otherwise specified.

Alameda County: 1, High-grade clays were at one time mined near Tesla (p. 38).

Amador County: 1, A number of clay deposits occur in the Ione formation, and have been mined in the vicinity of Carbondale and Ione (p. 51).

Calaveras County: **1**, The Ione formation near Valley Springs carries some high-grade clays (p. 68).

Orange County: **1**, A deposit of flint fire clay occurs on the Goat Ranch, Santa Ana Canyon (p. 140).

Placer County: **1**, Valuable clay deposits in the Ione formation are found near Lincoln (p. 147).

Riverside County: **1**, The Alberhill-Corona area is one of the three most important clay-producing areas in the state, and most of the better clays in the county have come from this district (p. 162, 163).

San Bernardino County: **1**, Several deposits of high-grade clays occur in the county; those in the Hart Mountains are the most interesting (secs. 13, 24, T. 14 N., R. 17 E., S. B.), (p. 194). **2**, Another deposit in the same region is half a mile south of the old mining town of Hart (p. 197).

Shasta County: **1**, Thick incoherent deposits of kaolinite occur with alunite and opal on the flanks of Brokeoff Mountain, Lassen National Park, H. Williams (1) p. 249.

Sonoma County: **1**, A deposit of white kaolin fire clays occurs (sec. 3, T. 6 N., R. 6 W., M. D.) east of Beltane Station (p. 227). **2**, Miloschite has been found at the Devils Pulpit, The Geysers, Vonsen (p. c. '45).

* KEMPITE, 1924

Hydrous manganese oxychloride, $MnCl_2 \cdot 3MnO_2 \cdot 3H_2O$

Orthorhombic. Minute prismatic crystals. Color emerald green. H. = 3½. G. = 2.94.

Soluble in dilute acids. Gives water in the closed tube.

Santa Clara County: **1**, Minute green crystals of kempite, associated with pyrochroite, hausmannite, and other manganese minerals, were found in the manganese boulder in Alum Rock Park, near San Jose. It was described and named by A. F. Rogers (27) p. 145.

Analysis (by Crook)

Mn	Cl	H_2O	O*
50.59	16.41	11.60	21.40 = 100%

* By difference

A. F. Rogers (53) p. 1944 notes the relationship of kempite to atacamite.

KERMESITE

Antimony oxysulphide, Sb_2S_2O

Monoclinic. Usually in hair-like tufts. Cleavage, one perfect. Metallic to adamantine luster. Color cherry red. Streak brownish red. H. = 1-1½. G. = 4.5-4.6.

Gives a reaction similar to stibnite.

Kern County: **1**, Fine red needles of kermesite were found in 1899 on stibnite at the Mojave antimony mine, about 15 miles north of Mojave, S. M. B. (15346). **2**, Kermesite was reported from the Kramer district, as small cherry red spherules with kramerite, Mineral Notes and News (4) p. 13. According to Frondel (p.c. '48) this is not kermesite, but an unidentified and possibly new mineral.

Mono County: **1**, Kermesite was found sparingly in the early mining in the Blind Spring Hill district. Hoffman (1) p. 737.

* KERNITE, 1927

Hydrous sodium borate, $Na_2B_4O_7 \cdot 4H_2O$

Monoclinic. Cleavages, two perfect; one distinct. Vitreous to pearly luster. Colorless to white. Transparent. H. = 3. G. = 1.953.

Fuses with swelling to a clear glass. Slowly soluble in cold water.

Rasorite has been used as an alternative name.

Kern County: **1,** Kernite was described by Schaller (41) p. 24, as a new mineral from the Kramer district (sec. 22, T. 11 N., R. 8 W., S. B.), where it forms the principal ore mineral of the borate deposits. Its occurrence and crystallography have been treated fully by Schaller (45) p. 146, and the X-ray structure determined by Garrido (1) p. 469.

Analysis (by Schaller)

Na_2O	B_2O_3	H_2O	Insol.
22.63	50.76	26.50	0 = 99.89%

KINRADITE

See quartz, chalcedony

* KNOXVILLITE, 1890

See magnesio-copiapite

KOBELLITE

Lead bismuth sulphide, possibly $Pb_2(BiSb)_2S_5$

Massive, fibrous or radiated, fine granular. H. = 2.5-3. G. = 6.3. Color blackish lead gray to steel gray.

Mariposa County: **1,** A specimen, S. M. B. (16074) from the Eureka and Excelsior mines is perhaps this species.

KONINCKITE

Hydrous iron phosphate, $FePO_4 \cdot 3H_2O$

Small spherical aggregates of radiating needles. H. = 3. G. = 2.4. Fusible. Color yellow.

San Benito County: **1,** A specimen of koninckite, S. M. B. (20781) came from the New Idria mercury mine, W. W. Bradley (24) p. 251.

KOTSCHUBEITE

See chlorite, clinochlore

KRAMERITE

See probertite

* KRAUSITE, 1931

Hydrous iron and potassium sulphate, $K_2SO_4 \cdot Fe_2(SO_4)_3 \cdot 2H_2O$

Monoclinic. Rough crystals, often prismatic. One cleavage perfect, one good. Brilliant luster. Color lemon yellow to yellowish green. H. = 2½. G. = 2.84.

B.B. decrepitates and finally changes to a black scoriaceous mass. Soluble in acid.

San Bernardino County: **1,** Krausite was discovered, described and named by Foshag (19) p. 352, from the "sulphur hole," just below the borax mines in the Calico Hills. It is in yellow grains and crystals associated with alunite, coquimbite, voltaite, etc.

Analysis (by Foshag)

CaO	FeO	Fe_2O_3	K_2O	Na_2O	SO_3	SiO_2	H_2O	Insol.
0.12	0.24	24.94	14.71	0.64	51.05	2.19	5.59	0.92 = 100.40%

KRÖHNKITE

Hydrous sulphate of copper and sodium, $CuSO_4 \cdot Na_2SO_4 \cdot 2H_2O$

Monoclinic. Crystalline; massive, coarsely fibrous. Two cleavages. H. = 2.5. G. = 2.06. Very easily fusible. Color azure blue.

Alameda County: **1**, Salvadorite has been recorded from the Alma mine, Leona Heights, Schaller (1) p. 207. The identity of salvadorite with kröhnkite has been shown by Gordon (2) pp. 1-4.

KUNZITE

See spodumene

KYANITE—Disthene—Cyanite

Aluminum silicate, Al_2SiO_5

Triclinic. In long slender or blade-like crystals. One cleavage, perfect. Vitreous to pearly luster. Color blue, green, white, gray, black. Streak uncolored. H. = 5-7. G. = 3.56-3.67.

Infusible and insoluble. Like andalusite in its behavior before the blowpipe. It can be distinguished from andalusite and sillimanite by its physical properties, especially the great difference in hardness in different directions.

Kyanite is a metamorphic mineral found in schists and gneisses with andalusite, sillimanite, and dumortierite.

Imperial County: **1**, Kyanite occurred abundantly with quartz and black tourmaline at the property of the Vitrefrax Corporation, 3 miles north of Ogilby on the west slope of the Cargo Muchacho Mountains, Tucker (11) p. 269, Sampson and Tucker (4) p. 455. Campbell and Wright (2), p. 1520.

Inyo County: **1**, Kyanite occurred about 7 miles northwest of Death Valley Junction, in the Amargosa Range, W. W. Bradley (28) p. 343.

Los Angeles County: **1**, Kyanite was found with corundum in gneiss on Santa Catalina Island, E. H. Bailey (1) p. 1955.

Riverside County: **1**, Kyanite occurred in the Golden Charlotte mine west of Perris, W. W. Bradley (30) p. 194.

San Bernardino County: **1**, Crystals of kyanite have been found in a contact zone in marble, Furnace Canyon, Baker (1) p. 337.

San Diego County: **1**, It has been reported from an unspecified locality in this county, Friederich (1) p. 22.

Tuolumne County: **1**, It is a constituent of the schists on Yankee Hill, Sampson and Tucker (4) p. 457.

LABRADORITE

See feldspar

LAPIS LAZULI

See lazurite

LAUMONTITE

Hydrous calcium, sodium, and aluminum silicate, $(Ca,Na)_7Al_{12}(Al,Si)_2Si_{26}O_{80} \cdot 25H_2O$

Monoclinic. Radiating or divergent columnar. Cleavages two perfect. Vitreous luster. Color white. Streak uncolored. H. = 3½-4. G. = 2.25-2.36.

Fuses easily to a glass and shows the reddish flame of calcium. Gelatinizes with hydrochloric acid. Gives water in a closed tube.

Laumonite is a zeolite occurring in cavities of basic volcanic rock, usually with other zeolites.

Inyo County: **1,** A large crumbly mass of interlocking prisms was found in No. 4 glory hole of the Pine Creek tungsten mine, in the contact zone of the scheelite ore, Hess and Larsen (17) p. 276.

Los Angeles County: **1,** Matted prismatic crystals and friable masses, in crevices in basalt, have been found at south end of Cahuenga Pass, Neuerberg (1) p. 156. **2,** Mulholland drive west of Cahuenga Pass, locality 4, ibid. p. 156. **3,** Large crumbly masses of very small crystals occur in Soledad Canyon above the mouth of Agua Dulce Creek, Porter (p.c. '49).

Mendocino County: **1,** Laumontite occurs as the cement of Cretaceous sandstone at Anchor Bay, Gilbert (2) p. 1517.

Plumas County: **1,** Minor amounts of laumontite were identified at the Engels mine, Graton and McLaughlin (4) p. 18.

Riverside County: **1,** It occurs in the Crestmore limestone quarries, as fibrous masses on green prehnite, Eakle (15) p. 352. At the same locality it is found in pegmatites or pegmatite-like masses, as white friable aggregates or interlacing crystals, and also as compact masses of radiating or columnar crystals 3 to 8 millimeters long, or in cavities, Woodford et al. (10) p. 371.

San Bernardino County: **1,** Fibrous white laumontite in large veins has been found near the Grant mine, on the right slope of Cucamonga Canyon, S. M. B. (12479), Woodford (p. c., '44).

San Diego County: **1,** It occurred in Moosa Canyon, near Bonsall, Schaller (18) p. 37, associated with axinite. **2,** It has been found in minute crystals at Rincon, A. F. Rogers (4) p. 214. **3,** Rosettes and sprays of thin columnar crystals have been found in the pegmatites at Pala, Jahns and Wright (5) p. 42.

* LAWSONITE, 1895

Calcium and aluminum silicate, $CaAl_2Si_2O_7(OH)_2 \cdot H_2O$

Orthorhombic. Prismatic and tabular crystals. Two perfect cleavages. Vitreous luster. Color pale blue to white. H. = 7-8. G. = 3.09.

Swells and fuses to a frothy mass. Very slightly acted on by hydrochloric acid. Yields water in a closed tube.

Lawsonite was discovered in 1895 as a new mineral in schists, and has been found to be widespread in the metamorphic rocks of the Coast Ranges.

Alameda County: **1,** Lawsonite was found in seams in an outcrop of glaucophane schist near the head of Arroyo Mocho, A. F. Rogers (13) p. 106, in crystals up to one centimeter in length. **2,** As tabular crystals up to 5 millimeters across, in the extreme southeast corner of Tesla quadrangle, ibid. p. 109.

Contra Costa County: **1,** It was found in a chlorite boulder on the hillside north of Berkeley, Thelen (1) p. 221, Eakle (7) p. 84.

Humboldt County: **1,** The northernmost recorded occurrence of lawsonite is near Yager, A. F. Rogers (13) p. 111.

Los Angeles County: **1,** It is a microscopic constituent of the crossite schists of Santa Catalina Island, and **2,** in the San Pedro Hills, Woodford (1) p. 55.

Marin County: **1,** The original discovery of lawsonite was made by F. L. Ransome (3) p. 301, in the schists of the Tiburon Peninsula, half

a mile east of Reed Station. Crystals from the type locality were studied by Schaller and Hillebrand (4) p. 195.

Analyses: 1. Ransome and Palache, Ransome (3); 2. Schaller and Hillebrand (4).

	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	MgO	K_2O	Na_2O	Ign.	Total
1.	38.10	—	28.88	0.85	—	—	18.26	0.23	—	0.65	11.42	98.39%
	37.32	—	35.14		—	—	17.83	—	—	—	11.21	101.50%
2.	38.45	0.38	31.35	0.86	0.10	tr.	17.52	0.17	0.23	0.06	11.21	100.33%

Mendocino County: **1**, It was found in a large glaucophane-schist outcrop on Burger Creek, 2 miles northwest of Dos Rios, Vonsen (p. c., '32). **2**, Crystals of lawsonite occur in Franciscan schist near Covelo, at the headwaters of Jumpoff Creek, S. G. Clark (p. c., '32). The mineral occurs in fine euhedral tabular crystals of pale pink color, up to 2 inches in length, Chesterman (p. c. '51).

San Benito County: **1**, Lawsonite occurs with pumpellyite in the contact zone of jadeite on Clear Creek, Yoder and Chesterman (1) p. 3. **2**, Gray lawsonite occurs in veins in glaucophane schist, sec. 21, T. 14 S., R. 10 E., M. D., at the north end of Glaucophane Ridge.

San Diego County: **1**, It is found in the San Onofre breccia, Woodford (2) p. 192.

San Luis Obispo County: **1**, Platy crystals of lawsonite in masses of green chlorite occur about 4 miles east of San Luis Obispo, Eakle (7) p. 86, A. F. Rogers (13) p. 111. **2**, Lawsonite is found in glaucophane-lawsonite schist near Cayucos, J. P. Smith (1) p. 213.

San Mateo County: **1**, Lawsonite-glaucophane schist has been found 3 miles southwest of Redwood, J. P. Smith (1) p. 212, Eakle (7) p. 86.

Santa Barbara County: **1**, Lawsonite is found sparingly in schist pebbles collected from Tertiary sediments, at the northeast corner of Santa Rosa Island, T. L. Bailey and Woodford (1) p. 191.

Santa Clara County: A. F. Rogers (13) records lawsonite from the schists of many localities in the county: **1**, acicular crystals in cavities and seams of loose boulders, north end of Calaveras Valley, p. 108; **2**, in the Mount Hamilton area, crystals up to 4 millimeters, p. 108; **3**, Colorado Creek, p. 109; **4**, Smith Creek near Santa Clara Hotel, p. 111. **5**, Lawsonite-glaucophane schist, made up almost entirely of these two minerals, is reported by J. P. Smith (1) p. 212 from 1, the San Juan mine, Oak Hill, near San Jose; 2, one mile south of Coyote Canyon.

Sonoma County: **1**, Veins of dull green lawsonite occur with pumpellyite in glaucophane schist, at Mill Creek, Irving et al. (1) p. 338. **2**, With pumpellyite at Camp Meeker, 2 miles north of Occidental (sec. 16 (?), T. 7 N., R. 10 W., M. D.), Vonsen (p. c., '23). **3**, Good crystals were found on the highway half a mile south of Cazadero (sec. 21, T. 8 N., R. 10 W., M. D.), Vonsen (p. c. '45). **4**, Lawsonite occurs with glaucophane 2 miles north of Valley Ford (sec. 15 (?), T. 6 N., R. 10 W., M. D.), Vonsen (p. c. '45). A specimen, S.M.B. (21317) from 2½ miles northeast of Valley Ford, confirms Vonsen. **5**, Lawsonite-glaucophane schist occurs at Guerneville, J. P. Smith (1) p. 212.

LAZULITE

Basic aluminum, iron and magnesium phosphate, $(Fe,Mg)Al_2(OH)_2P_2O_8$

Monoclinic. Sharp-pointed pyramids. Massive, granular. Brittle. Vitreous luster. Color azure blue. Streak white. H. = 5-6. G. = 3.05.

Infusible. Falls to pieces when heated. Fused with sodium carbonate and then dissolved in nitric acid, the yellow phosphate precipitate is obtained by adding to ammonium molybdate solution. Yields water in a closed tube. Insoluble.

Alpine County: **1**, Bands of lazulite with andalusite and rutile in garnetiferous quartzite occur 10 miles south-southwest of Markleeville, W. W. Bradley (28), p. 207.

Inyo County: **1**, Lazulite occurs in a vein in schist in Breyfogle Canyon, Chloride Cliff area (T. 30 N., R. 1 E., S. B. approx.), Cloudman et al. (1) p. 864. **2**, Lazulite is found in the Lee mining district, 30 miles southeast of Keeler, S. M. B. (20758).

Kern County: **1**, Lazulite has been reported from an unspecified locality in this county, Pecora and Fahiz (1) p. 14.

Modera County: **1**, Lazulite, originally identified as lazurite, has come from Wawona, in the Minaret district, S. M. B. (18136).

Mono County: **1**, Lazulite occurs in considerable amount in the great andalusite mass in the White Mountains, Kerr (3) p. 629, Woodhouse (4) p. 38, Lemmon (2) p. 945, Jeffrey and Woodhouse (4) p. 6, and as crystals up to 2 inches in size in the Vulcanus claim on the opposite side of Dry Creek Canyon, Kerr (3) p. 629. **2**, Large deep-blue anhedrons of lazulite occur with rutile and andalusite 1 mile west of Green Lake (sec. 28 (?), T. 3 N., R. 24 E., M. D.), A. F. Rogers (7) p. 375.

San Bernardino County: **1**, Occurs crystalline and massive in vein associated with quartz, muscovite, talc, tremolite and specularite, 7 miles southeast of Hodge, 200 yards west of Globerson Iron mine. Bowen (1) p. 135.

San Diego County: **1**, A specimen of lazulite, S. M. B. (13591), came from Oceanside, Kunz (24) p. 98.

LAZURITE—Lapis Lazuli

Sodium and aluminum silicate, with sodium sulphide, $Na_{8-10}Al_6Si_6O_{24}\cdot S_2$

Isometric. In cubes and dodecahedrons. Massive. Vitreous luster. Color azure blue, violet blue. H. = 5-5½. G. = 2.38-2.45.

Fuses with intumescence. Soluble in hydrochloric acid and yields gelatinous silica on evaporation.

Madera County: **1**, A specimen reported from the Minarets (Ritter Range) has been shown to be lazulite, Murdoch (p. c., '45).

Mono County: **1**, Lazurite has been doubtfully reported from the Andalusite mine in the White Mountains, Peck (1) p. 152, but this was not confirmed by Kerr (3) p. 629. **2**, It is listed as occurring near Mono Lake, Kunz (24) p. 98, but this may refer to the Green Lake occurrence of lazulite.

San Bernardino County: **1**, A small prospect pit (NE¼ sec. 6, T. 1 N., R. 7 W., S. B.) in Cascade Canyon has produced a little lapis lazuli as patches and grains in a mica-diopside schist. It was first found as boulders in the bed of San Antonio Creek, and traced to the outcrop. Surr (6) p. 1153, A. F. Rogers (7) p. 377, (44) p. 111. Rogers con-

siders it to be a sulphide-bearing haüyne. Lazurite, presumably from this locality, was early (1867) mentioned by C. W. King (1), footnote p. 273.

LEAD

Native lead, Pb

Isometric. Crystals rare. Usually in thin plates and pellets. Malleable. Metallic luster. Color lead gray. H. = 1½. G. = 11.4.

Easily fusible. Heated on charcoal, it gives a yellow coating. Soluble in hot dilute nitric acid.

Native lead is an exceedingly rare mineral and its reported occurrence as a true mineral is sometimes open to doubt. Small bits of lead found in the placer gravels may be portions of lead bullets, but the occurrence of the metal in deep placer mines is indicative of its origin as a natural reduction product.

Butte County: **1**, Small subangular fragments of lead, 3 to 4 millimeters in size, have been found 14 miles east of Chico, in the West Fork Feather River, A. F. Rogers (7) p. 373.

Kern County: **1**, It has been doubtfully reported from the dry placers at Goler (N. R.).

Placer County: **1**, Small pellets of lead, possibly native, have been found in a placer mine in North Ravine, Edgewood district, near the Ophir district (N. R.).

LEADHILLITE

Hydrous carbonato-sulphate of lead, $4PbO \cdot SO_3 \cdot 2CO_2 \cdot H_2O$

Monoclinic. Tabular crystals. Cleavage perfect basal. Vitreous to pearly luster. Color white, yellowish, greenish. Streak uncolored. H. = 2½. G. = 6.26-6.44.

Easily reduced on charcoal to metallic lead, giving a yellow coating. Effervesces briskly in nitric acid. Barium chloride precipitates, from the acid solution, barium sulphate. Gives a small amount of water in a closed tube.

Inyo County: **1**, Small, imperfect crystals of leadhillite, of a pale sea-green tint, were found with linarite and caledonite at the Cerro Gordo mine, A. F. Rogers (1) p. 46.

LECHATELIERITE

Fused quartz, SiO_2

Riverside County: **1**, Fragments of fused quartz (lechatelierite), associated with some cristobalite, have been found in sand fulgurites near Indio, A. F. Rogers (50) p. 120.

LEPIDOCROCITE

FeO(OH)

Orthorhombic. Usually isolated flakes or groups of scale-like crystals. Massive, bladed to fibrous. Cleavages, one perfect, one good. Brittle. H. = 5. S.G. = 4.09. Luster submetallic. Color ruby red to reddish brown. Streak dull orange.

Occurs under the same conditions as goethite, and often associated with it.

Shasta County: It has been recorded from Iron Mountain, Palache et al. (10), p. 644.

LEPIDOLITE—Lithia Mica

Hydrous potassium, lithium, and aluminum silicate, $K(Li,Al)_3(Si,Al)_4O_{10}(O,OH,F)_2$

Monoclinic. In aggregates of short prisms. Commonly in scaly masses; sometimes in broad plates. Cleavage perfect basal. Vitreous to pearly luster. Color gray, lilac, lavender, violet blue, pink to colorless. H. = 2½-4. G. = 2.8-3.3.

Easily fusible to a white globule, and shows the red flame of lithium. Nearly insoluble in acids. A small amount of water which reacts acid is obtained in a closed tube by intense ignition.

This usually pink or lavender mica, characteristic of the lithia-tourmaline pegmatites, was first noted in California in 1856 by Antisell (1) p. 187, and then in 1881, by W. P. Blake (23) p. 376, who reported it with rubellite from the "Bernardino Range in Southern California."

Inyo County: **1,** White lepidolite is doubtfully reported from Surprise Canyon, R. W. Raymond (5) p. 34.

Riverside County: **1,** Lepidolite, with tourmaline, kunzite, and amblygonite, is abundant in the Fano mine (SW¼ sec. 33, T. 6 S., R. 2 E., S. B.), Kunz (23) p. 968. **2,** It occurs in platy cleavelandite with colored tourmaline, on the southeast slope of Coahuila Mountain (NE¼ sec. 16, T. 7 S., R. 2 E., S. B.), Fisher (1) p. 67. **3,** Fine-grained, scaly, lilac lepidolite is found in moderate abundance in the Anita mine (sec. 22, T. 6 S., R. 1 E., S. B.), Fisher (1) p. 84.

San Bernardino County: **1,** Lepidolite from an unspecified locality gave Papish and Holt (1) p. 142, traces of gallium.

San Diego County: The best general reference to lepidolite in this county is to be found in Bulletin 37 of the California State Division of Mines by Kunz (24). **1,** A large body of massive lepidolite, some with intergrown needles of pink tourmaline, occurs in the Stewart mine at pala, Fairbanks (5) p. 36, Kunz (24) pp. 55, 100. Fine-to course-grained lepidolite associated with lithia tourmalines also occurs ,in all the other mines in the district. Analyses and spectroscopic tests have shown some unusual elements in these lepidolites: cesium, Kennard and Rambo (1) p. 454; cesium and rubidium, Stevens (1) p. 617; germanium, Papish (2) p. 473. Kennard and Rambo (2) p. 108, found .67 percent rubidium and .16 percent cesium with spectroscopic traces of gallium and thallium in lepidolite from the Sickler mine at Pala. **2,** Good crystals of lepidolite have been found in the pegmatites near Ramona (secs. 6, 9, T. 13 S., R. 2 E., S. B.), Schaller (8) p. 143, (7) p. 225. **3,** Lepidolite is abundant in the lithia pegmatites at Mesa Grande, Kunz (24) p. 100. Stevens (1) p. 617 found rubidium and cesium on analysis of material from here. **4,** Lepidolite occurs in the Victor mine at Rincon, A. F. Rogers (4) p. 214. The mineral occurs also in the southern extension of the Clark dike, with spodumene and beryl, Hanley (3) p. 20, 23. **5,** It is found with amblygonite at Granite Mountain (NW¼ sec. 18, T. 13 S., R. 5 E., S. B.), near Banner, Pratt (5) p. 314, Van Amringe (1) p. 1. **6,** It occurs with cassiterite, columbite, and blue tourmaline in a small pegmatite on the east side of Chihuahua Valley (SW¼ sec. 12, T. 9 S., R. 3 E., S. B.), Schaller (36) p. 353. This lepidolite also shows cesium and rubidium, Stevens and Schaller (3) p. 531. **7,** Lepidolite occurs with tourmaline in the Pete Labat (French Pete, Elinor) mine (SW¼ sec. 36, T. 9 S., R. 3 E., S. B.), Tucker and Reed (26) p. 40. **8,** It occurs with gem tourmaline

at Oak Grove, Kunz (24) p. 100. Cesium and rubidium have been found in analyses, Stevens (1) p. 617. **9,** An early report by Antisell (1) p. 187, records lepidolite near San Felipe.

LEPIDOMELANE

Near biotite in composition, but characterized by a large amount of ferric iron

H. = 3. G. = 3.1. Color black, brown. Cleavage perfect, basal. Properties in general the same as biotite.

Kern County: **1,** A specimen of lepidomelane, S. M. B. (15674) came from Isabella.

LIMONITE—Brown Hematite

Hydrous oxide of iron, $Fe_2O_3 \cdot nH_2O$

Not crystallized. Massive. Compact, stalactitic, botryoidal, columnar, fibrous, earthy. Submetallic to dull luster. Color ocher yellow, brown to black. Streak yellowish brown. H. = 5-5½. G. = 3.6-4.

Becomes magnetic on heating. Soluble in hydrochloric acid, and brown ferric hydrate is precipitated by ammonia. Yields water in a closed tube.

The name limonite formerly was given to a hydrous iron oxide with the supposed formula $2Fe_2O_3 \cdot 3H_2O$. It has been shown that "limonite" is usually cryptocrystalline goethite with absorbed or capillary water. The name is conveniently used for any natural hydrous iron oxide which is otherwise unidentified. It may occur in stalactitic, botryoidal or mammillary forms, and as spongy masses, or coatings. It varies quite widely in appearance, but always has a yellow-brown streak, and submetallic to dull luster.

It is formed by the weathering of minerals containing iron, and is very common as the "gossan" or "iron hat" forming a surface capping of pyrite ore bodies. It may be used locally as an ore of iron, but is not as important as hematite or magnetite for this purpose. It is frequently abundant enough to be used as a mineral pigment, the "yellow ochre" corresponding to the "red ochre" of powdery or massive hematite. It is universally present in all parts of California, but only the most important occurrences can be cited. The deposits used for mineral paints are listed and described by Symons (1) pp. 148-160, but none of these are of particular mineralogic interest, and most are of minor commercial importance.

Inyo County: **1,** Pseudomorphs of limonite after long crystals of stibnite have been observed at the Cerro Gordo mine (N. R.).

Mariposa County: **1,** Pseudomorphs of limonite after pyrite cubes have been found in Chowchilla Valley, Hanks (7) p. 200.

Placer County: **1,** The limonitic gossan of some of the old mines—for example the Dairy Farm—in the Foothill copper belt have been mined in recent years for their gold content, Murdoch (p. c. '45).

Shasta County: **1,** Beautiful stalactites of limonite have been found in the gossan at Bully Hill, Diller (7) p. 128. **2,** Iridescent stalactites up to 4 inches in length and 1 inch in diameter have been collected at Iron Mountain, Lang (1) p. 561. **3,** Some stalactites from Charles Camden's mine were on display at the California Midwinter Fair in 1894, Benjamin (1) p. 153.

Trinity County: **1,** Very large cubes of limonite, pseudomorphous after pyrite, are found in the Golden Jubilee mine, Carrville district, MacDonald (2) p. 31.

Tulare County: **1**, The Mineral King district has furnished some good pseudomorphs of limonite after pyrite, S. M. B. (10865).

LINARITE

Basic sulphate of lead and copper, $(Pb,Cu)SO_4 \cdot (Pb,Cu)(OH)_2$

Monoclinic. Small crystals, divergent columnar and platy. Cleavage, one perfect. Vitreous to adamantine luster. Color deep azure blue. Streak pale blue. H. = 2½. G. = 5.3-5.45.

Reactions for linarite are like those for caledonite. The two are often associated, but are easily distinguished by color.

Inyo County: **1**, Beautiful divergent, columnar masses of deep azure-blue linarite were obtained in the Cerro Gordo mines during the early days of mining, the specimens sometimes being banded with green caledonite and brochantite. Fine crystals were also obtained from pockets and cavities in the massive mineral, A. F. Rogers (1) p. 46, Eakle (9) p. 225, Waring and Huguenin (2) p. 97. **2**, Thin platy crystals of linarite were found with aurichalcite and malachite at the Defiance mine, Darwin district, Murdoch and Webb (14) p. 323, and at the Wonder Prospect, with caledonite, in the same district, A. Knopf (4) p. 17. **3**, It occurred in oxidized ores at the Reward mine, 2 miles east of Manzanar Station, A. Knopf (5) p. 118. **4**, Linarite, with caledonite and cerussite, was found at the Monster mine, on the east flank of the Inyo Range, northwest of Saline Valley, A. Knopf (5) p. 111.

Madera County: **1**, It was found with anglesite on the Bliss claims near Davis Lake, Minaret district, Erwin (1) p. 70.

Mono County: **1**, Hulin (p. c. '36) reports linarite from Blind Spring Hill.

San Bernardino County: **1**, Linarite occurs in the Ibex (Arcturus) mine 6 miles north of Saratoga Springs, with argentiferous galena and cerussite, Waring and Huguenin (2) p. 96, Cloudman et al. (1) p. 821. **2**, Reported with caledonite and dioptase from near Baker in the Soda Lake Mountains, S.M.B. (21350), Murdoch (p. c. '49).

Tulare County: **1**, It was found with cerussite and anglesite at the Copper Queen mine, S. M. B. (18680).

LIROCONITE

Hydrous aluminum and copper arsenate

Monoclinic. Thin tabular crystals. Vitreous luster. Color and streak sky blue to verdigris green. H. = 2-2½. G. = 2.88-2.98.

Fusible. Can be reduced to metallic copper on charcoal with sodium-carbonate flux, and yields a slight coating of arsenic. Ammonia added to a nitric-acid solution will precipitate flocculent aluminum hydroxide, while the solution becomes blue. Gives water in a closed tube and also an arsenical mirror when vapors are reduced by a splinter of charcoal. Soluble in nitric acid.

Inyo County: **1**, Liroconite was found at the old Cerro Gordo mine associated with other rare copper minerals, (N. R.).

LITHARGE

Lead monoxide, PbO

Tetragonal. Scaly masses. Color lemon yellow to orange yellow. H. = 2. G. = 9.13.

Fuses easily to a yellow glass. Easily reduced on charcoal to metallic lead, and gives yellow coating.

Inyo County: **1**, Litharge has been found 9 miles east of Big Pine, W. W. Bradley (29) p. 106. **2**, It was reported in the Darwin (New Coso district), Wheeler (3) p. 57.

Kern County: **1**, It has been recorded in plates bordered by massicot, from an unspecified locality in the county, Larsen (4) p. 18.

San Bernardino County: **1**, Brownish-orange-red scales of litharge bordered by massicot were found near Cucamonga Peak, Hanks (12) p. 256, Larsen (4) p. 18. Hanks (12) p. 256 suggests that this might have come from a prehistoric ore furnace.

LITHIA MICA

See lepidolite

LITHIOPHILITE

Lithium and manganese phosphate, $LiMnPO_4$

Orthorhombic. Commonly massive. Cleavage perfect basal. Vitreous luster. Color pale pink to yellow and brown. H. = 4½-5. G. = 3.42-3.56.

Easily fusible. Fuses with a red flame. The sodium carbonate bead is blue green. Soluble in acid. The phosphate reaction is obtained when the nitric-acid solution is added to ammonium molybdate.

San Diego County: **1**, Lithiophilite was found with purpurite and triphylite at Pala, Graton and Schaller (1) p. 146, Schaller (22) p. 79, (29) p. 145, Jahns and Wright (5) p. 40.

LITHOMARGE

See kaolinite

LODESTONE

See magnetite

LOELLINGITE

Iron diarsenide, $FeAs_2$

Orthorhombic. Small crystals. Usually massive. Metallic luster. Color silver white to light steel gray. Streak grayish black. H. = 5-5½. G. = 7.0-7.4.

Similar to arsenopyrite in its reactions except that it gives no sulphur deposit in a closed tube.

Amador County: **1**, Small crystals of loellingite were found in veins in slate at the Mayflower gold mine, Amador City, S. M. B. (14161).

Inyo County: **1**, A little loellingite was found with arsenopyrite and pyrrhotite at the Bishop Creek mine, 18 miles southwest of Bishop, Schroter (2) p. 53.

Riverside County: **1**, Loellingite forms the central part of lenses of sulphides in coarse-grained marble of the underground workings at Crestmore, Kelley (2) p. 141.

San Diego County: **1**, Loellingite is very rare, usually associated with phosphates, on Queen and Heriart Mountains, Pala, Jahns and Wright (5) p. 42.

LUDLAMITE

Hydrous phosphate of iron, manganese, and magnesium, $(Fe'',Mg,Mn)_3(PO_4)_2 4H_2O$

Monoclinic, tabular crystals or massive. One perfect cleavage. H. = 3½. G. = 3.12-3.19. Luster vitreous. Color bright green to apple green. Occurs in pegmatite as an alteration of triphylite.

San Diego County: **1,** Ludlamite is reported from the Pedro mine, Pala, Anon. (19) p. 265, Frondel (p.c. '51). It occurs as small greenish patches in lithiophilite.

LUDWIGITE

Magnesium and iron borate, $3MgO \cdot B_2O_3 \cdot FeO,Fe_2O_3$

Orthorhombic. Small fibrous or prismatic masses. Silky luster. Color blackish green to black. H. = 5. G. = 3.991-4.02.

Fusible into a magnetic mass. Soluble in hydrochloric and sulphuric acids, but insoluble in nitric acid. Yellow turmeric paper dipped into the hydrochloric-acid solution, turns red when dried. Magnesia can be precipitated by sodium phosphate after the boron and iron have been removed.

El Dorado County: **1,** Scaly masses originally identified as ludwigite, from the Cosumnes mine near Fairplay, A. F. Rogers (7) p. 375, have been shown to be biotite or some similar micaceous mineral, Schaller (p.c. '46).

Fresno County: **1,** Ludwigite occurs as needle-like crystals in metamorphosed dolomitic limestone in Twin Lakes region, Chesterman (p.c. '55).

Kern County: **1,** Ludwigite was identified (see under Riverside County) in some of the cassiterite ores at Gorman, 4 miles north of Quail Lake, Wiese and Page (1) p. 50, Page (3) p. 202.

Riverside County: **1,** A few black prisms in the margin of the limestone body at Crestmore have been tentatively identified as ludwigite, Woodford et al. (10) p. 365.

Schaller (p.c. '46) suggests that the Kern and Riverside County occurrences may be paigeite rather than ludwigite.

LUZONITE

See famatinite

MACKINTOSHITE

See thorogummite

MAGHEMITE

Fe_2O_3

Isometric, closely related to magnetite in crystal structure. Color brown. Streak brown. Highly magnetic. Principally an alteration product derived from magnetite, or by dehydration from lepidocrocite.

Alameda County: **1,** Maghemite was reported from this county, no detail of location given, Newhouse and Glass (2) p. 701.

Riverside County: **1,** Brown-coated lodestone from the Eagle Mountain iron mine contains maghemite, Crippen (p.c. '49).

Shasta County: **1,** Maghemite is reported from the gossan at Iron Mountain, Sosman and Posjak (1) p. 332; Newhouse and Glass (2) p. 701.

MAGNESIA ALUM

See pickeringite

MAGNESIO-COPIAPITE

Hydrous basic sulphate of ferrous and ferric iron with variable amounts of chromium, aluminum, nickel, and magnesium, $(Mg,Fe)Fe_4(SO_4)_6(OH)_2 \cdot 2H_2O$

Triclinic. Tabular crystals. Cleavage perfect pinacoidal. Vitreous luster. Color greenish yellow. H. = $2\frac{1}{2}$-3. G. = 2.08-2.17.

Napa County: **1,** Greenish-yellow masses of this complex mineral described originally as knoxvillite and as a new mineral from California, have been found with redingtonite and mercury minerals at the old Redington (Boston) mine at Knoxville, Becker (4) p. 389, Melville and Lindgren (1) p. 24. It is considered by Larsen (11) p. 61 to be a variety of copiapite, and is established as magnesio-copiapite by Berry (1) p. 21.

MAGNESIOFERRITE

Oxide of iron and magnesium, $MgFe_2O_4$

One of the magnetite series. Color and streak black. Luster metallic-adamantine. Magnetic. G. = 4.6±. H. = 5½-6½. Nearly opaque.

Riverside County: **1,** Black shiny crystals of this mineral, showing cube, octahedron and dodecahedron, have been found in the crystalline limestone of the Crestmore quarry, Schwartz (p.c. '53).

San Benito County: **1,** Brilliant black octahedrons almost 1 mm across in chlorite schist from near the benitoite mine, were identied as magnesioferrite, Murdoch (p.c. '50).

MAGNESITE

Magnesium carbonate, $MgCO_3$

Hexagonal-rhombohedral; scalenohedral. Crystals are rare. Generally compact massive; sometimes earthy. Cleavage perfect rhombohedral. The compact massive variety shows no cleavage, but shows a flat conchoidal fracture. Brittle. Luster vitreous, sometimes silky. Color snow white to brown. H. = 3½-4½. G. = 3.0-3.12.

Cold dilute hydrochloric acid has little effect on magnesite, but heated acid causes it to effervesce freely. The solution, when treated by ammonia, ammonium oxalate, and sodium phosphate, will give an important precipitate only when the last reagent is used. Magnesite moistened with cobalt nitrate and intensely heated will turn pink.

Magnesite is widespread in California because of the great areas of serpentine, of which it is an alteration product. The serpentine is commonly intersected by veins and patches of snow-white to light-buff magnesite. Some of these veins are commercially important. The main deposits lie in the serpentine belts of the Coast Ranges, but deposits also occur in serpentines in the foothills of the Sierra Nevada and elsewhere. The mineral is mostly in cryptocrystalline masses with prominent conchoidal fracture, and the siliceous varieties are very hard. The magnesite deposits of California have been described in Bulletin No. 79, W. W. Bradley (8) of the State Division of Mines.

Alameda County: **1,** Several deposits of magnesite occur on Cedar Mountain, containing stringers of magnesite in serpentine (secs. 27, 35, T. 4 S., R. 3 E., M. D.), W. W. Bradley (8) pp. 41, 43. **2,** Magnesite occurs as boulders, none in place, at Hayes Ranch (SW¼ sec. 24, T. 4 S., R. 2 E., M. D.), ibid., p. 42.

Del Norte County: **1,** Stringers of magnesite up to 4 inches by 6 feet are found in serpentine at the Camp 7 group (sec. 7, T. 16 N., R. 3 E., H.), J. E. Allen (2) p. 121.

Fresno County: **1,** Massive white veins of magnesite occur in serpentine at the Piedra mine (secs. 5, 9, T. 13 S., R. 24 E., M. D.), Goldstone (1) p. 185, Hess (5) p. 50, W. W. Bradley (8) p. 44. **2,** Magnesite is reported from the Vance mine, Pine Flats, Yale and Stone (5) p. 7.

Humboldt County: **1,** Small veins of magnesite are found in a road cut between Willow and Hoopa, Laizure (3) p. 319.

Inyo County: **1,** Reported from the J. E. Gould mine near Owenyo, Yale and Stone (5) p. 7.

Kern County: **1,** A deposit of bedded magnesite has been found 1½ miles north of Bisell (NE¼ sec. 11, T. 10 N., R. 11 W., S. B.), H. S. Gale (12) p. 512, W. W. Bradley (8) p. 47. **2,** Good specimens of magnesite have come from Walkers Pass, Hess (5) p. 39.

Kings County: **1,** Boulders and segregations of magnesite in serpentine occur (sec. 20, T. 23 S., R. 16 E., M. D.) in a deposit which extends into Monterey County, W. W. Bradley (8) p. 51.

Los Angeles County: **1,** A small deposit of magnesite occurs in serpentine 18 miles from Saugus (secs. 11, 12, T. 6 N., R. 15 W., S. B.), W. W. Bradley (8) p. 52.

Madera County: **1,** Magnesite in 3-foot veins is reported a quarter of a mile south of Grub Gulch, Laizure (6) p. 343.

Mariposa County: **1,** Magnesite occurs at Big Spring Hill (sec. 30, T. 5 S., R. 19 E., M. D.), Laizure (6) p. 148.

Mendocino County: **1,** Small deposits of magnesite in serpentine occur on the Hixon Ranch (sec. 11, T. 12 N., R. 11 W., M. D.), Hess (5) p. 21; **2,** Southard Ranch, W. W. Bradley (8) p. 52; **3,** near Willits, Yale and Gale (4) p. 395.

Monterey County: **1,** A continuation of the deposit found in Kings County is about 3 miles east of Parkfield, W. W. Bradley (8) p. 53.

Napa County: A number of magnesite veins in serpentine occur in the county: **1,** at Pope Valley (sec. 2, T. 9 N., R. 5 W., M. D.), Hess (5) p. 28; **2,** Chiles Valley (sec. 28, T. 8 N., R. 4 W., M. D.), ibid. p. 29. W. W. Bradley (19) p. 275, reports some crystalline pale to greenish magnesite in veins here; **3,** Soda Valley (secs. 25, 36, T. 8 N., R. 4 W., M. D.), Crawford (1) p. 328. Additional reference to segregations and veins in serpentine, Weaver (1) p. 174.

Nevada County: **1,** Nearly pure magnesite in serpentine was found in the Idaho-Maryland mine, Lindgren (12) p. 115. **2,** Stringers and veins of magnesite occur in serpentine in secs. 25, 36, T. 18 N., R. 10 E., M. D., Averill (13) p. 74.

Placer County: **1,** Magnesite, sometimes in considerable quantities, occurs in veins in serpentine in the central part of the county near Towle, Gold Run, Iowa Hill, Michigan Bluff and Damascus, (T. 15, 16 N., R. 10, 11 E., M. D.), Hanks (12) p. 257, G. E. Bailey (2) p. 103, H. S. Gale (12) p. 501, W. W. Bradley (8) p 59.

Riverside County: **1,** A large deposit of magnesite veinlets in a mass of serpentine, was mined near Winchester (NW¼ sec. 31, T. 5 S., R. 1 W., S. B.), Hess (5) p. 38, W. W. Bradley (8) p. 61.

San Benito County: Magnesite veinlets occur widespread in the serpentines of the county. **1,** One large deposit is at the Sampson magnesite claims (secs. 34, 35, 36, T. 17 S., R. 11 E., M. D.), H. S. Gale (12) p. 503.

San Bernardino County: **1,** A bedded deposit of magnesite 10 to 20 feet thick occurs on the east side of Cave Canyon (sec. 21?, T. 11 N., R. 6 E., S. B.), Hewett et al. (1) p. 117. **2,** Another bedded deposit, interstratified with dolomite occurs southwest of Needles (secs. 15, 22,

T. 8 N., R. 21 E., S. B.), Schlocker (1) p. 9, Tucker and Sampson (33) p. 138. Further description of several deposits near Needles, Vitaliano (1) p. 363. **3**, Massive 2 to 4 foot veins in dolomitic limestone occur 10 miles northwest of Cima in the Ivanpah Mountains, Tucker and Sampson (16) p. 314, secs. 15, 16, T. 15 N., R. 14 E., S. B., Wright et al. (5) p. 184. **4**, Thick beds of magnesite, interstratified with dolomitic clay and bentonite, occur 4 miles southeast of Kramer Station (secs. 3, 4, T. 9 N., R. 6 W., S. B.), Tucker and Sampson (32) p. 67, Wright et al. (5) p. 184. **5**, Veins of magnesite up to several feet in thickness occur 12 miles east of Victorville near the Victor Cement Company properties, Yale and Gale (4) p. 581, sec. 2, T. 6 N., R. 2 W., S. B., Wright et al. (5) p. 184.

San Francisco County: **1**, A little magnesite occurs with xonotlite on Army Street, San Francisco, Pabst (p. c., '44). **2**, At Fort Point, as seams in serpentine, Eakle (1) p. 316.

San Luis Obispo County: **1**, Small veins of magnesite occur in serpentine on the Kiser Ranch about 9 miles northwest of Cambria, W. W. Bradley (8) p. 76. **2**, A large deposit is reported on the Steele Ranch 7 miles east of Arroyo Grande, Franke (2) p. 426.

Santa Barbara County: **1**, Small stringers in serpentine are found in Happy Canyon (sec. 15, T. 7 N., R. 29 W., S. B.), W. W. Bradley (8) p. 77.

Santa Clara County: **1**, An extensive deposit of magnesite occurs at the Sherlock and other mines, Red Mountain district (T. 6 S., R. 5 E., M. D.), Hess (5) p. 33, Bodenlos (1) p. 238. **2**, Many other deposits, all similarly veins in serpentine, are found in the county, near Edenville, Coyote Station, Madrone, W. W. Bradley (8) pp. 78, 79, 87. **3**, A. F. Rogers (25) p. 138 has described euhedral crystals from a narrow vein in the San Juan quicksilver mine, 5 miles south of San Jose. **4**, Pods of magnesite occur with chromite in serpentine on the Smith property, sec. 35, T. 7 S., R. 1 E., M. D., Davis and Jennings (6) p. 337.

Sonoma County: Many deposits, all as veins in serpentine, occur in the county: **1**, Kolling (Creon) deposit (sec. 32, T. 12 N., R. 10 W., M. D.) 2 miles north of Cloverdale, W. W. Bradley (1) p. 325; **2**, Yordi (Ekert) Ranch 2 miles southeast of Cloverdale, Hess (5) p. 23; **3**, Gilliam Creek deposits (sec. 31, T. 9 N., R. 10 W., M. D.), ibid. p. 24; **4**, Red Slide (secs. 16, 17, 21, T. 9 N., R. 11 W., M. D.), 6 miles north of Cazadero, W. W. Bradley (1) p. 327. **5**, Small crystals forming a crust with barite and dolomite are reported from the Great Eastern mine, Guerneville, Vonsen (p. c., '45).

Stanislaus County: **1**, The Bald Eagle and Quinto claims (sec. 32, T. 8 S., R. 7 E., M. D.), Perry and Kirwan (1) p. 1, Boalich (4) p. 254, have produced much magnesite. **2**, The Smith mine (T. 6 S., R. 6 E., M. D.), near Patterson has produced some magnesite, F. L. Lowell (1) p. 629. **3**, Lenses in serpentine occur at the Red Mountain mine (sec. 20, T. 6 S., R. 5 E., M. D.), W. W. Bradley (8) p. 98.

Tulare County: Very many deposits occur in the general area covered by townships 18-22 S., ranges 26-28 E., M. D., W. W. Bradley (8) pp. 106-135. Some of the more important localities are: Deer Creek, Alpha, east of Strathmore; Porterville area.

Tuolumne County: **1**, The Gray Eagle, Monarch and other claims near Chinese Camp (T. 1 S., R. 14 E., M. D.), have shipped some magnesite, W. W. Bradley (8) p. 138.

MAGNETIC PYRITES
See pyrrhotite

MAGNETITE
Iron oxide, Fe_3O_4

Isometric. Octahedral crystals, compact and granular massive. Metallic luster. Color iron black. Streak black. H. = $5\frac{1}{2}$-$6\frac{1}{2}$. G. = 5.1.

Strongly magnetic. Soluble in hydrochloric acid, and reddish ferric hydrate precipitated on the addition of ammonia. Distinguished from hematite by streak and magnetism.

Lodestone is a variety possessing natural polarity.

Magnetite is one of the most abundant of the iron minerals, and several good deposits of it occur in the state. It is a minor constituent of most igneous rocks, and occurs in this manner in all the counties. The black sands of streams and beaches have been derived from the weathering of such rocks and the concentration of the magnetite grains, together with chromite, garnet, zircon and many other heavy, hard minerals. Only the more important or interesting occurrences can be listed.

Butte County: **1**, Lodestone has been found in a deposit near Chaparral Hill (T. 26 N., R. 5 E., M. D.), J. R. Browne (4) p. 224.

Calaveras County: **1**, Well-formed octahedrons of magnetite occur in talc schist at the Melones mine, Carson Hill, A. Knopf (11) p. 37. Massive magnetite has come from the Iron Rock mine, Carson Hill, S. M. B. (13696).

El Dorado County: **1**, Veins up to $4\frac{1}{2}$ feet have been reported from the Reliance mine (sec. 18, T. 10 N., R. 9 E., M. D.), Logan (9) p. 441. **2**, Large boulders were found by W. P. Blake (3) p. 82, (5) p. 289, at Volcanoville.

Fresno County: **1**, Magnetite is the principal vein mineral, with bornite, in the Uncle Sam mine opposite Tehipite Dome, the Kings River, W. W. Bradley (2) p. 438. **2**, Magnetite is abundant in parts of the "skarn" of a scheelite deposit at Twin Lakes, Chesterman (1) p. 276.

Inyo County: **1**, Microscopic crystals of magnetite occur in lithophysae in obsidian, with tridymite, near Coso Hot Springs, Rutley (1) p. 426, A. F. Rogers (23) p. 215. **2**, A considerable quantity of lodestone was reported from the Slate Range, Hanks (12) p. 258.

Kern County: **1**, A considerable mass of magnetite was reported 3 miles south of the San Emigdio mine, Angel (2) p. 226. **2**, A 3-foot vein of magnetite was reported near the summit of "Cañada de las Uvas" (Grapevine Canyon), W. P. Blake (3) p. 82, (5) p. 289.

Los Angeles County: **1**, Important masses of titaniferous magnetite (with microscopically intergrown ilmenite) have been found in the western San Gabriel Mountains, 1 mile southwest of the Monte Cristo mine, and in T. 3, 4 N., R. 12, 13, 14 W., S. B., in anorthosite, Tucker (13) p. 296, W. J. Miller (5) p. 335, (7) p. 22. **2**, Masses of magnetite associated with cinnamon garnet, chlorite, and hornblende were found in the New Pass (Soledad Canyon), by W. P. Blake (3) p. 82, (5) p. 289.

Madera County: **1**, Large deposits of magnetite are found on the western slope of Iron Mountain, Minaret district, Goldstone (1) p. 191, Erwin (1) p. 63. **2**, Extensive deposits of magnetite, with pyrite, are reported at Iron Creek (T. 5 S., R. 22, 23 E., M. D.), R. P. McLaughlin and Bradley (3) p. 554. **3**, Lodestone has been found at the Sparkling iron mine, Kings Creek district, S. M. B. (12853).

Mono County: **1**, Magnetite occurs as an important mineral in the veins of the Benton, Lundy, and other districts, Whiting (1) p. 389. **2**, It was found coated with greenockite at the South 40 claim (T. 8 N., R. 22 E., M. D.), near the Golden Gate mine, West Walker River district, Eakle and McLaughlin (17) p. 141.

Nevada County: **1**, Lodestone was found on Grouse Ridge, 14 miles north of Washington, J. R. Browne (4) p. 224. **2**, A large deposit occurs at the contact of granodiorite and diabase 4 miles south of Indian Springs, Lindgren and Turner (10) p. 6, E. M. Boyle (1) p. 59.

Placer County: **1**, A large deposit of magnetite, which was worked from 1881-86 by blast furnace, occurs at Hotaling, 5 miles west of Clipper Gap, Lindgren (13) p. 3, C. A. Waring (4) p. 390.

Plumas County: **1**, A large deposit of magnetite occurs just west of Wades Lake, Turner (14) p. 8.

Riverside County: **1**, Magnetite is a very minor mineral at Crestmore, in the Lone Star quarry, Woodford et al. (10) p. 366. **2**, A very large mass of iron ore at Eagle Mountain (T. 4 S., R. 14 E., S. B.) is composed partly of magnetite, Harder (6) p. 63. **3**, Small crystals, separate or in clusters, and sometimes badly weathered, are found in the Southern Pacific silica quarry at Nuevo, Fisher (1) p. 34.

San Bernardino County: **1**, A large mass of magnetite-hematite ore occurs at the Iron Age mine (sec. 29, T. 1 S., R. 13 E., S. B.), 6 miles east of Dale, Tucker and Sampson (17) p. 334. **2**, At Iron Mountain (secs. 27, 28, T. 6 N., R. 4 E., S. B.), in the Lava Beds district, is a series of massive veins of magnetite and hematite, ibid. p. 335. **3**, There are other deposits of magnetite in the Providence Mountains (T. 10 N., R. 13 E., S. B.), Cave Canyon (T. 11 N., R. 7 E., S. B.), Kingston Mountains (T. 25 S., R. 11 E., M. D.), Crossman (1) p. 235, Cloudman et al. (1) p. 820, Tucker and Sampson (17) p. 334, Lamey (5) p. 87. **4**, Magnetite and hematite occur in the Ship Mountain deposits (T. 5 N., R. 15 E., S. B.), Lamey (7) p. 113. **5**, Magnetite is found with hematite at Iron Hat (T. 6 N., R. 14 E., S. B.), Lamey (6) p. 99. **6**, Hematite and magnetite occur in the Old Dad Mountain deposit (sec. 13, 14 ?, T. 12 N., R. 10 E., S. B.), Lamey (3) p. 61. **7**, Magnetite is found with hematite in the Silver Lake district, Iron Mountain deposits (T. 15 N., R. 6, 7 E., S. B.) Lamey (2) p. 39.

Santa Cruz County: **1**, Layers of black sand up to 6 inches in thickness occur at Aptos; they are composed largely of magnetite and ilmenite, Katz (1) p. 463, Laizure (4) p. 75.

Shasta County: **1**, A large deposit of magnetite at Heroult was worked by electric smelter, Logan (7) p. 12. **2**, An extensive deposit occurs near the junction of McCloud and Pit Rivers, McGregor (1) p. 641. **3**, Magnetite occurs in quantity at Iron Mountain, Hanks (7) p. 195. **4**, A large deposit used mainly as heavy aggregate in naval construction, occurs at the Shasta Iron Company property (sec. 26, T. 34 N., R. 4 W., M. D.), J. C. O'Brien (1) p. 82. **5**, At the Black

Diamond mine (secs. 2, 3, T. 33 N., R. 4 W., M. D.) magnetite occurs as a contact mineral with pyrrhotite and chalcopyrite, Tucker (11a) p. 146. **6,** A small deposit of magnetite, with garnet and epidote, occurs at the Hirz Mountains deposit (T. 35 N., R. 3 W., M. D.), Lamey (8) p. 131.

Sierra County: **1,** A large body of magnetite, some of it lodestone, is found at the Sierra iron mine (secs. 11, 12, T. 21 N., R. 11 E., M. D.), Hanks (7) p. 195, Aubury (3) p. 304. **2,** Perfect octahedral crystals in talcose slate have come from Forest City, S. M. B. (10443). **3,** Massive magnetite is found southeast of Spencer Lakes (T. 22 N., R. 10 E., M. D.), Turner (14) p. 8.

MAITLANDITE

See thorogummite

MALACHITE

Basic cupric carbonate, $CuCO_3 \cdot Cu(OH)_2$

Monoclinic. Crystals usually slender, grouped in tufts and rosettes. Commonly massive or incrusting, botryoidal, reniform, or stalactitic. One perfect cleavage. Brittle. Luster of crystals adamantine to vitreous; of fibrous varieties more or less silky. Color bright green. Streak pale green. H. = $3\frac{1}{2}$-4. G. = 3.9-4.03.

B.B. fuses at 2, coloring the flame emerald green; on charcoal is reduced to metallic copper. In the closed tube blackens and yields water. Soluble in acids with effervescence.

Malachite is the commonest and most conspicuous oxidation product of copper minerals, and is present in practically all mineral deposits, even those carrying only a minor amount of copper sulphides. Accordingly, it is impossible to list all occurrences, and only those of particular interest will be recorded.

Amador County: **1,** Fine reniform masses have come from Volcano (N. R.).

Calaveras County: **1,** Fine specimens of massive malachite with crystallized copper have been found in the Union mine, Irelan (3) p. 151, Reid (3) p. 398. **2,** Fine specimens of malachite and azurite have been found in the Hughes mine, W. P. Blake (9) p. 17, Hanks (12) p. 259.

Humboldt County: **1,** Excellent specimens have come from the Horse Mountain mine, Laizure (3) p. 306.

Inyo County: **1,** Good drusy specimens have come from the Cerro Gordo mine, S. M. B. (18357).

Mariposa County: **1,** Fine drusy coatings and excellent crystallized malachite occur at the White Rock mine, S. M. B. (15741).

Mono County: **1,** It is rather abundant in the Blind Springs Hill district, especially the Kerrick mine, Hanks (12) p. 259, A. L. Ransome (2) p. 190. **2,** Malachite occurs with cuprite and chrysocolla at the Detroit mine, in the Jordan district, Whiting (1) p. 364.

Monterey County: **1,** J. B. Trask reported malachite from the old silver mine at Alisal rancho, Hanks (12) p. 259.

Placer County: **1,** Malachite was abundant at the Algol mine (sec 9, T. 13 N., R. 7 E., M. D.), Aubury (1) p. 173.

Plumas County: **1,** Alternating bands of malachite and chrysocolla were found at the Engels mine, Kunz (24) p. 102. **2,** Large masses of malachite in limestone occur in the Genesee district, Logan (4) p. 463.

San Diego County: 1, Excellent specimens of malachite have come from 3 miles south of Julian [perhaps from the Friday mine], S. M. B. (9980).

Santa Clara County: 1, Malachite occurs with crystallized cinnabar in crystalline calcite from the Guadalupe mine, Kunz (24) p. 107, S. M. B. (4929).

Tuolumne County: The reference to malachite, azurite, and other oxidation minerals at Whiskey Hill, in earlier editions of this Bulletin should be to Placer County, near Lincoln, see Silliman (7) p. 351.

MALDONITE

See bismuth-gold

MANGANITE

$MnO(OH) = Mn_2O_3 \cdot H_2O$

Monoclinic; pseudo-orthorhombic. Color dark steel gray to iron black. Streak chocolate brown. Hardness 4. Sp. gr. 4.3. Occurs in prismatic crystals. Commonly altered to pyrolusite.

There are numerous small deposits of manganese oxides in the state, and much of the ore may be manganite mixed with psilomelane or pyrolusite. Unless crystals are present, it is impossible to identify manganite without x-ray methods, P. D. Trask et al. (4) p. 54.

In general, manganite may be present in any of these oxide deposits, so that its occurrences are possibly numerous. It has rarely been definitely identified in the state.

Imperial County: 1, Minor amounts of manganite are found with pyrolusite and psilomelane in the Paymaster district (secs. 16, 18, 19, T. 11 S., R. 21 E., S. B.), Tucker (11) p. 266, Hadley (1) p. 465.

San Diego County: 1, Manganite is found associated with manganese-bearing albite at the Catharina mine, Pala, Schaller (29) p. 145, Kraus and Hunt (2) p. 465.

Shasta County: 1, Minute crystals of manganite have been found in cavities and fractures in quartz at the Murray mine (sec. 1, T. 32 N., R. 6 W., M. D.), L. C. Raymond (p. c. '36).

MANGANOCALCITE

See calcite

MANGANOTANTALITE

See columbite

MARCASITE

Iron disulphide, FeS_2

Orthorhombic. Commonly in tabular crystals. Massive; radiating fibrous; in stalactites. Brittle. Metallic luster. Color pale brass yellow. Streak brownish black. H. = 6-6½. G. = 4.85-4.90.

Roasted on charcoal, it gives sulphur odor and yields a magnetic residue. Distinguished from pyrite by crystal form.

Marcasite is rarer than pyrite, and is usually found in the upper portions of sulphide ore deposits.

Amador County: 1, Marcasite is found with pyrrhotite and other sulphides at the Defender mine, 5 miles southeast of Volcano, Tucker (1) p. 27.

Calaveras County: 1, It is reported from the West Point district, Franke and Logan (4) p. 239.

Colusa County: **1,** Marcasite occurs with stibnite, gold, and cinnabar at the Manzanita mine, Becker (4) p. 367.

Contra Costa County: **1,** Marcasite is found with cinnabar and metacinnabar at the Mount Diablo (Ryne) mine (SE¼ sec. 29, T. 1 N., R. 1 E., M. D.), A. L. Ransome and Kellog (1) p. 377, C. P. Ross (2) p. 41.

Del Norte County: **1,** Marcasite is found at Patrick Creek (T. 18 N., R. 3 E., H.), Laizure (3) p. 287.

Inyo County: **1,** It has been identified microscopically in massive pyrrhotite at the Curran mine, half a mile north of Panamint, Murphy (2) p. 314, (4) p. 367.

Kern County: **1,** Marcasite occurs with gold quartz at the Bowman mine (sec. 20, T. 28 S., R. 34 E., M. D.), Tucker and Sampson (21) p. 293. **2,** In the Big Blue group (T. 25 S., R. 33 E., M. D.), Prout (1) p. 413. **3,** In the Green Mountain district (T. 29 S., R. 34 E., M. D.), Tucker and Sampson (21) pp. 296, 307. **4,** In small amounts in the gold veins of Soledad Mountain, Mojave district, Tucker (23) p. 469.

Lake County: **1,** Marcasite occurs with cinnabar and metacinnabar at the Baker mine (sec. 16, T. 12 N., R. 6 W., M. D.), Becker (4) p. 368. **2,** Pseudomorphs of cinnabar and tiemannite after marcasite have been observed from the Abbott mine (sec. 32, T. 14 N., R. 5 W., M. D.), Watts (2) p. 240. **3,** Marcasite is found in the Red Elephant mine, Knoxville district, Averitt (1) p. 88. **4,** Considerable marcasite was found in some of the ores of the Helen mine (sec. 1, T. 10 N., R. 8 W., M. D.), Tucker (36) p. 276,

Los Angeles County: **1,** Marcasite occurs at the head of Mill Creek, near the Monte Cristo mine, R. J. Sampson (10) p. 187.

Mono County: **1,** Marcasite is found in quartz veins with pyrite and galena at the King group (T. 3 S., R. 31 E., M. D.), W. W. Bradley (29) p. 144.

Napa County: **1,** It occurs with metacinnabar at the Redington mine, Knoxville (secs. 6, 7, T. 11 N., R. 4 W., M. D.), A. L. Ransome and Kellog (1) p. 410. **2,** Botryoidal and stalactitic marcasite has come from the Palisades mine about 2 miles north of Calistoga, S. M. B. (20376).

Nevada County: **1,** It was reported by Lindgren (7) p. 231 as one of the minor minerals at Grass Valley. **2,** It was found with copper sulphides in the Mineral Hill district (T. 15 N., R. 8 E., M. D., approx.), Forstner (4) p. 745.

Riverside County: **1,** Marcasite occurred at the Lucky Strike, between Perris and Elsinore, in a gold quartz vein, R. J. Sampson (9) p. 513.

San Bernardino County: Marcasite occurs in a number of gold mines in the county, in minor amounts: Colosseum (T. 17 N., R. 13 E., S. B.); Paymaster (T. 13 N., R. 10 E., S. B.); Vanderbilt, 4 miles east of Ivanpah, Tucker and Sampson (17), pp. 292, 217, 330; Cumberland (sec. 25, T. 6 N., R. 2 E., S. B.); Coarse Gold, east slope of Providence Mountains, Tucker and Sampson (27) p. 63, (28) p. 234.

San Diego County: **1,** Several mines in the Descanso region have a little marcasite, Tucker (8) p. 371.

Solano County: **1,** A small amount of marcasite occurs in the cinnabar ore at the St. John mine, NE¼ sec. 33, T. 4 N., R. 3 W., M. D., Weaver (1) p. 170.

Tuolumne County: **1,** Marcasite occurs sparingly 2 miles northwest of Columbia, Tucker (1) p. 138.

Ventura County: 1, Marcasite is found with gold at the White Mule mine on the north slope of Frazer Mountain, Tucker and Sampson (20) p. 257.

Yolo County: 1, Marcasite is reported from the Reed mine, Averitt (1) p. 86.

MARGARITE

Hydrous calcium and aluminum silicate, $CaAl_4Si_2O_{10}(OH)_2$

Monoclinic. Usually in aggregated laminae, sometimes massive; scaly. Cleavage perfect basal. Brittle. Pearly luster. Color grayish pink. H. = 3½-4½. G. = 2.99-3.08.

Fuses with difficulty. Yields water in the closed tube. Slowly decomposed by hydrochloric acid.

Margarite is prominent in the glaucophane rocks and has been observed in several localities.

Calaveras County: 1, It has been found at the Gold Cliff mine, near Angels. S. M. B. (15483).

Marin County: The margarite mentioned by F. L. Ransome (3) p. 309, from Reed Station, Tiburon Peninsula, has been identified as muscovite by Eakle (7) p. 83.

Plumas County: 1, Margarite occurs with corundum in the plumasite 1½ miles northwest of Meadow Valley post office, Pratt (6) p. 42.

San Mateo County: 1, It is a microscopic constituent of the schists of Belmont, Murgoci (1) p. 391.

Santa Clara County: 1, It occurs with garnet and glaucophane at Hilton Gulch, Oak Ridge, J. P. Smith (1) p. 203.

Sonoma County: 1, It is a microscopic constituent of the glaucophane gneiss of Melitta, near Santa Rosa, Murgoci (1) p. 389.

MARGARODITE—Damourite

See muscovite

MARIALITE

See scapolite

* MARIPOSITE, 1868

Monoclinic. In hexagonal plates and scales, foliated, micaceous. Cleavage perfect basal. Vitreous luster. Color apple green, white. H. = 2½-3. G. = 2.78-2.81.

Similar to muscovite in its reactions. An emerald-green borax bead is sometimes obtained.

Mariposite is essentially a muscovite characteristically colored green by the presence of some chromium. It is abundantly distributed in the gold belt of the Sierra Nevada, and was described as a new mineral by Silliman (9) p. 380. It is considered by some mineralogists to be identical with alurgite, Schaller (35) p. 139. A good general description of all Mother Lode occurrences is given by A. Knopf (11) p. 38.

Calaveras County: 1, Mariposite occurs in schist at the Reserve and Golden Gate mines on Carson Hill, A. Knopf (11) p. 38.

El Dorado County: 1, Green flakes of mariposite occur in the Pyramid mine, 4 miles north of Shingle Springs (N. R.).

Imperial County: 1, It has been reported from this county, W. W. Bradley (28) p. 343.

Kern County: 1, Mariposite occurs in the Randsburg schists, Hulin (1) p. 25.

Los Angeles County: **1**, Mariposite occurs as nests and lenses in talc-sericite schists of the Sierra Pelona series, in San Francisquito Canyon, just above the old dam-site, Murdoch and Webb (6) p. 353.

Mariposa County: **1**, The original mariposite was described and named from the Josephine mine, Silliman (9) p. 380, Hanks (12) p. 260, Analysis, Turner (12) p. 679. It is common in the schists of this county.

	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	Fe_2O_3	FeO
Green	55.35	0.18	25.62	0.18	0.63	0.92
White	56.79	25.29		none	1.59	

	CaO	MgO	K_2O	$(Li,Na)_2O$	H_2O		
Green	0.07	3.25	9.29	0.12	4.52	= 100.13%	G. = 2.817
White	0.07	3.29	8.92	0.17	4.72	= 100.84%	G. = 2.787

Nevada County: **1**, Found in the Idaho-Maryland mine at Grass Valley, Lindgren (12) p. 115. **2**, At the Red Ledge mine, Washington, with quartz and calcite in veins (N. R.).

Placer County: **1**, It was found at the Marguerite mine (N. R.).

Riverside County: **1**, It was reported on the west side of San Jacinto Mountain (N. R.).

San Diego County: **1**, It was reported near Oak Grove (N. R.).

Sierra County: **1**, It was found at the Rainbow mine, S. M. B. (10442). **2**, It occurs at the Alhambra mine, Poker Flat district (sec. 10, T. 21 N., R. 10 E., M. D.), E. M. Boyle (3) p. 75. **3**, In the Forest and other districts, ibid., Lindgren (20) p. 105.

Tuolumne County: **1**, It is common in the Rawhide and other mines near Tuttletown, Turner and Ransome (15) p. 6, in the quartz gangue of the gold ores.

MARMOLITE

See serpentine

MARTITE

See hematite

MASCAGNITE

Ammonium sulphate, $(NH_4)_2SO_4$

Orthorhombic. Usually in crusts and stalactitic forms. One cleavage distinct. Vitreous to dull luster. Colorless, yellowish, greenish. H. = 2. G. = 1.76.

Very easily fusible. Soluble in water. Barium chloride added to the solution precipitates barium sulphate. Boiled in a test tube with potassium bisulphate, it gives off the odor of ammonia.

Sonoma County: **1**, It has been found with boussingaultite and epsomite near The Geysers, Goldsmith (7) p. 265, Vonsen (6) p. 288. The mineral occurs as incrustations and nodules during the early summer months, in the upper part of Geyser Creek Canyon.

MASSICOT

Lead monoxide, PbO

Orthorhombic. Usually in scales or scaly masses. Color brownish orange red, yellow. Soft. G. = 9.29.

Fuses easily to a yellowish glass. Easily reduced on charcoal to metallic lead, yielding yellow coating.

El Dorado County: **1**, Massicot was found at the Rescue mine, W. W. Bradley (26) p. 194, S. M. B. (20836).

Inyo County: **1**, Massicot was reported 9 miles southeast of Big Pine, W. W. Bradley (29) p. 106. **2**, It was found in the Darwin district, Loew (2) p. 186. **3**, It occurred with minium, wulfenite, and pyromorphite at Cerro Gordo, R. W. Raymond (9) pp. 29, 31, Loew (2) p. 186. It was abundant there in the early days.

Kern County: **1**, Fine scales of massicot have been found near Fort Tejon, Larsen (11) p. 106. A specimen of this is in the University of California Museum at Berkeley. **2**, Another specimen occurring as borders on litharge has been recorded by Larsen (4) p. 18, from this county.

Mono County: **1**, It has been found in the Blind Spring Hill district, probably mixed with massicot, bindheimite, and mimetite, A. L. Ransome (2) p. 189.

San Bernardino County: **1**, Massicot has been found in scales up to 1 millimeter across, and as borders on plates of litharge, Larsen (4) p. 18.

Trinity County: **1**, It has been reported from the northern part of the county, S. M. B. (20193).

MEERSCHAUM

See sepiolite

MEIONITE

See scapolite

MELACONITE

See tenorite

MELANTERITE—Copperas

Hydrous ferrous sulphate, $FeSO_4 \cdot 7H_2O$

Monoclinic. Fibrous, stalactitic, and concretionary; also massive. Cleavage, basal. Brittle. Vitreous luster. Color green to white. Streak uncolored. H. = 2. G. = 1.89-1.9.

Easily fusible. Becomes magnetic on heating. Easily soluble in water. Gives acid water in a closed tube. Astringent taste.

Melanterite is a common alteration product in mines containing pyrite or marcasite.

Alameda County: **1**, Melanterite is abundant as crystals or fibrous masses on the walls of the mine workings at the Alma pyrite mine, Leona Heights. Rather complex crystals from this occurrence have been measured and described, Schaller (1) p. 195.

Alpine County: **1**, White brittle crusts and greenish stalactite masses of melanterite have been found in the Leviathan sulphur mine, 7 miles east of Markleeville, Gary (1) p. 489, Nichols (1) p. 172.

Amador County: **1**, It occurred with mendozite on the walls of an old tunnel $1\frac{1}{2}$ miles north of Volcano (N. R.).

Contra Costa County: **1**, Melanterite was found in the Mount Diablo mine (SE$\frac{1}{4}$ sec. 29, T. 1 N., R. 1 E., M. D.), C. P. Ross (2) p. 42.

Lake County: **1**, Melanterite is abundant as stalactites in the Sulphur Bank mine, near Clear Lake, Hanks (15) p. 104. **2**, Brilliant green stalactites have been found in the Bradford quicksilver mine, Friedrich (1) p. 22.

Los Angeles County: **1**, Colorless crusts of melanterite associated with halotrichite and gypsum occur in pyritiferous boulders in conglomerate on Cahuenga Peak, in a road-cut below the television station (sec. 25, T. 1 N., R. 14 W., S. B.), Neuerburg (1) p. 159, locality 10.

Napa County: **1**, Long pale-green stalactites of melanterite were abundant in the old Redington mine, Knoxville, Kramm (1) p. 345. **2**, Hulin (p. c. '36) has reported it from the Palisades mine, 2 miles north of Calistoga.

Orange County: **1**, Fibrous crusts up to 5 inches thick occur on the walls of old workings at the Santiago coal mine, Santiago Canyon, Van Amringe (p.c. '36).

San Benito County: **1**, Botryoidal masses and silky fibers of melanterite are found in the old tunnels of the New Idria mine, Wilke (p. c. '36).

San Bernardino County: **1**, Melanterite was found in old drifts of the California Rand and other mines of the area, Hulin (1) p. 99.

Santa Cruz County: **1**, Abundant white or greenish efflorescences of melanterite covered the sides and bottom of a ravine running to the sea northwest of Santa Cruz, J. B. Trask (2) p. 56, (4) p. 388.

Shasta County: **1**, It is fairly common in the copper mines of the county, Graton (3) p. 100.

Sonoma County: **1**, Drusy green melanterite has been found near Petaluma, S. M. B. (11832). **2**, It occurs as incrustations at The Geysers, Irelan (3) p. 633. **3**, Melanterite has been observed as occurring sparingly at The Geysers, Vonsen (6) p. 291.

Trinity County: **1**, It occurred with other sulphates at the Island Mountain mine, M. Vonsen (p.c. '17).

MELNIKOVITE

See pyrite

* MELONITE, 1867

Nickel telluride, $NiTe_2$

Hexagonal. Commonly granular and foliated. Cleavage perfect basal. Metallic luster. Color reddish white. Streak dark gray. H. = 1-1½. G. = 7.3.

The tellurium is readily driven off in white oxide fumes when heated on charcoal. The roasted residue yields the brown bead of nickel with borax. Melonite also gives the characteristic violet solution of a telluride when boiled in strong sulphuric acid.

Calaveras County: **1**, Melonite was discovered on Carson Hill in 1867 and named by Genth (4) p. 86, (5) p. 313. **2**, It was also found in the Stanislaus mine associated with hessite (?) and native tellurium (?), Genth (5) p. 313; analysis by Hillebrand (3) p. 60.

	Te	Ni,Co	Pb	Ag
Genth	73.43	20.98	0.72	4.08 = 99.21%
Hillebrand	80.75	18.31	--	0.86 = 99.92%

MENACCANITE

See ilmenite

MENDOZITE

Hydrous aluminum and sodium sulphate, $Na_2SO_4 \cdot Al_2(SO_4)_3 \cdot 22H_2O$

White fibrous masses or powder. H. = 3. G. = 1.73. Very easily fusible. Gives strong yellow flame. Soluble in water.

Amador County: **1,** Crusts of mendozite and melanterite occur on the walls of an old tunnel 1½ miles north of Volcano (N. R.).

Napa County: **1,** It occurs on the Pritchard Ranch 9 miles southeast of St. Helena (N. R.).

San Bernardino County: **1,** Platy and fibrous white mendozite occurs 5 miles north of Hidden Springs, S. M. B. (18698).

MENEGHINITE

Sulfide of lead and antimony, $Pb_{13}Sb_7S_{23}$

Orthorhombic, crystals slender prismatic, also occurring massive, fibrous to compact. One perfect cleavage. Brittle, luster metallic, streak black, color blackish lead gray. H. = 2½. G. = 6.36.

Oxidized by concentrated HNO_3 with separation of antimony oxide and lead sulphate.

Santa Cruz County: **1,** This rare mineral has been found with frankeite and stannite in the contact rock of the Pacific Limestone Products quarry, 2 miles west of Santa Cruz. Milton, Chesterman (p.c. '54).

MERCURY—Quicksilver

Native mercury, Hg

Liquid. Forms small fluid globules in the matrix which is usually cinnabar. Brilliant metallic luster. Color tin white. G. = 13.59.

Vaporizes at comparatively low heat and disappears; the vapors are invisible. Soluble in nitric acid.

Liquid globules of mercury are common in most of the cinnabar mines, formed either by reduction of the sulphide or by sublimation of mercuric vapors. It occurs in deep workings and in those parts of ill-ventilated mines where intense heat is developed by the decomposition of iron sulphides. It is also frequently found near the walls of cinnabar veins.

Del Norte County: **1,** Mercury was found in sec. 18, T. 18 N., R. 3 E., H., J. C. O'Brien (1) p. 78. **2,** It was reported from the Rockland district (sec. 11, T. 18 N., R. 2 E., H.), Mining and Scientific Press (16) Aug. 15. **3,** Plentiful mercury was found with cinnabar in the veins of the Webb mine, SE¼ sec. 20, T. 18 N., R. 3 E., H., O'Brien (9) p. 281.

Kings County: **1,** It occurred in the Kings mine with cinnabar in serpentine, W. W. Bradley (2) p. 529.

Lake County: **1,** Mercury is abundant in the Wall Street mine, S. M. B. (63). **2,** In the Bradford mine, Friedrich (1) p. 22. **3,** At the Great Western, Mirabel, and other mines west of Middletown, Crawford (1) p. 360. **4,** At the Chicago mine (sec. 1, T. 10 N., R. 8 W., M. D.), Aubury (2) p. 51.

Mariposa County: **1,** Mercury was found with gold amalgam at an unspecified locality in the county, Schmitz (1) p. 713.

Mendocino County: **1,** It is found 5 miles west of Orr Springs, Watts (2) p. 256.

Mono County: **1,** It was found with cinnabar in limonite in a canyon 4 miles north of Hammil Station (T. 2 S., R. 33 E., M. D.), Woodhouse (p.c. '45).

Napa County: **1,** It occurs in La Joya and other mines of the vicinity (sec. 24, T. 7 N., R. 6 W., M. D.), W. W. Bradley (5) p. 85, A. L. Ransome and Kellog (1) p. 410. **2,** It has been found in considerable amount in the mud of the hot springs on the east side of Napa Creek, near Calistoga, W. W. Bradley (5) p. 81.

Orange County: **1**, Small amounts have been reported at Red Hill, near Tustin, Fairbanks (4) p. 118. It is probable from the description that this is not metallic mercury, but metacinnabar, which does occur here with cinnabar.

San Benito County: **1**, It occurred in very considerable amount in certain parts of the New Idria mine. In one instance as much as one pint of mercury was collected at a single spot, W. W. Bradley (5) p. 97. **2**, It is found in the Alpine and other mines, Stayton district, ibid. **3**, Mercury globules have been found on cinnabar half a mile above the junction of Clear Creek and San Benito River, Watters (p.c. '51).

San Francisco County: **1**, Globules of mercury with cinnabar have been found in siliceous rock near Twin Peaks, San Francisco, J. D. Whitney (7) p. 78, W. W. Bradley (5) p. 124.

San Luis Obispo County: **1**, It has been found with metacinnabar at La Libertad mine, Adelaide district, Mining and Scientific Press (31) p. 323. **2**, The Oceanic mine, Von Leicht (1) p. 482.

San Mateo County: **1**, It was found with montroydite and cinnabar on the McGarvey Ranch about 3 miles from Redwood City on the Searsville road, Woodhouse (3) p. 603, Mining and Scientific Press (10) p. 357. **2**, It occurs on the Corte de Madera Rancho (?) 5 miles west of Palo Alto with cinnabar and calomel, W. W. Bradley (5) p. 149.

Santa Clara County: **1**, Small amounts have been found in the New Almaden mine, Huguenin and Castello (4) p. 222. **2**, It occurs in the Vaughn mine (sec. 14, T. 11 S., R. 6 E., M. D.) with cinnabar, Crawford (1) p. 358.

Siskiyou County: **1**, Found sparingly at the Great Northern mine, A. L. Ransome and Kellog (1) p. 459.

Sonoma County: **1**, Metallic mercury was the only ore mineral at the Rattlesnake mine (sec. 31, T. 11 N., R. 8 W., M. D.). The metal was so abundant that it would spurt out of the ore when a pick was sunk in, Egleston (1) p. 273, W. W. Bradley (5) p. 192. **2**, The main values were in metallic mercury in the Socrates (Pioneer) mine (sec. 32, T. 11 N., R. 8 W., M. D.), Aubury (2) p. 115, W. W. Bradley (5) p. 193. **3**, Considerable mercury occurred in the New Sonoma mine (secs. 4, 5, T. 10 N., R. 8 W., M. D.), W. W. Bradley (5) p. 191, and others in the Pine Flat district, ibid. p. 187. **4**, At the Esperanza mine on Sulphur Creek, ibid. p. 186. **5**, At the Clear Quill mine, Greenville district, S. M. B. (61). **6**, With metacinnabar at the Culver-Baer mine (sec. 23, T. 11 N., R. 9 W., M. D.), W. W. Bradley (5) p. 185. **7**, In a 10-foot shaft on the Wall tract (sec. 30, T. 8 N., R. 9 W., M. D.), 5 miles southwest of Santa Rosa, Aubury (1) p. 141, (4) p. 166.

Trinity County: **1**, Mercury was found with stibnite and cinnabar at the Altoona mine (T. 38 N., R. 6 W., M. D.), W. P. Miller (1) p. 716. **2**, It was reported with cinnabar and magnesite at the Integral mine (sec. 14, etc., T. 38 N., R. 6 W., M. D.), Mining and Scientific Press (25), p. 323.

* MERWINITE, 1921

Calcium and magnesium silicate, $Ca_3Mg(SiO_4)_2$

Monoclinic. Compact granular masses. One cleavage. Greasy to vitreous luster. Colorless to pale greenish. H. = 6. G. = 3.15.

Riverside County: **1**, Merwinite occurs as granular masses associated with gehlenite, spurrite, and wollastonite in the limestone quarries at

Crestmore. It was described and named by Larsen and Foshag (10) p. 143. It alters to thaumasite.

Analysis

SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	FeO	H_2O at 110°	H_2O ign
35.50	0.66	None	49.96	11.62	1.22	0.12	0.94 = 100.02%

MESOLITE

Hydrous sodium, calcium, and aluminum silicate, $Ca_2Na_2Al_6Si_9O_{30} \cdot 8H_2O$

Monoclinic. Acicular and capillary crystals. Generally silky fibrous crusts. Cleavage perfect prismatic and basal. Vitreous to silky luster. White or colorless. H. = 5. G. = 2.2-2.4.

Fuses with intumescence to a white vesicular glass. Soluble with gelatinization. Gives much water in a closed tube.

Mesolite is a zeolite generally occurring as silky fibrous crusts in cavities of basaltic rock.

Lassen County: **1**, Mesolite was observed in the lava of Lassen Peak, S. M. B. (10325).

Shasta County: **1**, It was found near Redding (N. R.).

Ventura County: **1**, Tufts of capillary snow-white mesolite occur lining the hollow amygdules of the lavas of Lockwood Valley (N. R.).

META AUTUNITE I AND II

See autunite

* METACINNABAR, 1870

Mercuric sulphide, HgS

Isometric. Usually massive. Brittle; but sectile when massive. Metallic luster. Color grayish black. Streak black. H. = 3.

Vaporizes with invisible fumes and gives a slight sulphur odor. Distinguished from cinnabar by its black color.

Colusa County: **1**, Metacinnabar was found with cinnabar and gold at the Manzanita mine in the Sulphur Creek district, Becker (4) p. 367.

Contra Costa County: **1**, Metacinnabar is the principal ore mineral mined, with subordinate cinnabar and stibnite to date (May 1937) at the Mount Diablo mine (old Ryne) (sec. 29, T. 1 N., R. 1 E., M. D.), C. P. Ross (2) p. 41.

Inyo County: **1**, It has been found at Coso Hot Springs, T. Warner (2) p. 59. **2**, Occurred in a small vein in limestone, with cinnabar, Chloride Cliff mine, C. A. Waring and Huguenin (2) p. 121. **3**, Metacinnabar occurs with stibnite at the Rocket claim, Argus Mountains, sec. 29, T. 22 S., R. 43 E., M. D., Norman and Stewart (2) p. 84.

Lake County: **1**, It was prominent in the Great Western, Hanks (84) p. 261, **2**, Baker, Becker (4) p. 286, and **3**, Abbott, Aubury (2) p. 47, mines. **4**, It occurs with mercury at the Mirabel mine (T. 10 N., R. 7 W., M. D.), A. L. Ransome and Kellog (1) p. 392. **5**, Also found in the Bradford mine (N. R.).

Monterey County: **1**, It occurs with the cinnabar in the Parkfield district (sec. 35, T. 22 S., R. 14 E., M. D.), Aubury (2) p. 124.

Napa County: **1**, Metacinnabar was discovered in the Redington or Boston mine, Knoxville, Durand (3) p. 220, Hanks (12) p. 261. **2**, In the Aetna mine (T. 9 N., R. 6 W., M. D.), Melville and Lindgren (1) p. 22. It occurred there in black seemingly amorphous masses and was described as a new mineral by G. E. Moore (1) p. 319, (2) p. 380, (3)

p. 36. Good crystals were later found in the same mine which showed the mineral to be isometric instead of amorphous, Penfield (1) p. 453. Analyses of metacinnabar from this mine were made by G. E. Moore (1) p. 319, and also by Melville and Lindgren (1) p. 22. It formed a large part of the ore in the upper levels. **3**, Metacinnabar was found coated with white calomel in the Oat Hill mine, S. M. B. (16284).

Orange County: **1**, Metacinnabar was found at Red Hill on the San Joaquin Ranch, disseminated through a ferruginous barite; analyzed by Genth, Genth and Penfield (10) p. 383. This occurrence was erroneously recorded as mercury in Bulletin 91 of the State Mining Bureau.

San Benito County: **1**, Large pieces of metacinnabar have been found in the New Hope vein of the New Idria mine, Becker (4) p. 302. **2**, It is found in black masses at the Picachos mine. A. F. Rogers (7) p. 373. **3**, Small amounts were found with cinnabar in the Bradford (Cerro Gordo) mine (sec. 3, T. 15 S., R. 8 E., M. D.), 11 miles west of Panoche, Becker (4) p. 380, Melville and Lindgren (1) p. 23, W. W. Bradley (5) p. 46. This occurrence has been mistakenly listed in Inyo County because of the identity in name of the mine with the Cerro Gordo mine of the latter county. **4**, Metacinnabar occurs on the Andy Johnsen claim, near Hernandez (Stanford University collection). **5**, With cinnabar in sandstone at the Valley View (T. 15 S., R. 10 E., M. D.), near Llanda, A. L. Ransome and Kellogg (1) p. 430. **6**, At the Butts mine (sec. 4, T. 16 S., R. 8 E., M. D.), W. W. Bradley (5) p. 101.

San Luis Obispo County: **1**, It has been found in the Adelaide district, Aubury (2) p. 160. **2**, In the Oceanic district (N. R.). **3**, In the Klau district, S. M. B. (15860).

Santa Clara County: **1**, Considerable amounts of metacinnabar have been found in the New Almaden and Guadalupe mines. Melville (3) p. 80, (1) p. 292, analyzed metacinnabar from the New Almaden mine and described the crystals as hexagonal, with some complex and doubtful forms. It has also been studied by G. E. Moore (3) p. 36. It is suggested by Wherry (3) p. 37, that this is guadalcazarite (zincian metacinnabar) but the percentage of zinc appears too low.

Solano County: **1**, It occurred with cinnabar in the Hastings mine (sec. 11, T. 3 N., R. 3 W., M. D.), near Benicia, W. W. Bradley (5) p. 172.

Sonoma County: **1**, Metacinnabar was found in the Culver-Baer mine (sec. 23, T. 11 N., R. 9 W., M. D.), east of Cloverdale, W. W. Bradley (5) p. 185. **2**, Metacinnabar occurs abundantly as small equant imperfect crystals, with cinnabar, curtisite, and realgar in sandstone at Skaggs Springs, F. E. Wright and Allen (3) p. 169, Everhart (4) p. 390. **3**, At the Commonwealth Consolidated mine, 2 miles from The Geysers, Crawford (1) p. 371. **4**, It was found in the Eureka mine (sec. 32, T. 11 N., R. 8 W., M. D.), Aubury (2) p. 106.

Yolo County: **1**, The ore of the California (Reed) mine was principally metacinnabar. Both crystals and amorphous metacinnabar occurred here, Hanks (12) p. 261, (15) p. 122.

METACINNABARITE

See metacinnabar

METASTIBNITE

Antimony trisulfide, Sb_2S_3(?)

Purplish gray. Streak red. Luster submetallic. H. = 2-3.

Inyo County: 1, Metastibnite has been reported with stibnite and oxides of antimony at the Bishop antimony mine, 4½ miles south of Bishop, C. D. Woodhouse (p.c., '45).

METASTRENGITE

Iron phosphate, $2(FePO_4)3\frac{1}{2}H_2O$

Orthorhombic. Crystals prismatic. Often in minute spherules. One perfect cleavage. H. = 3-4. G. = 2.76. Soluble in HCl. Fuses easily to a black bead. The name phosphosiderite has been changed to metastrengite, Dana, System of Mineralogy, 7th ed., vol. 2, p. 771. *Strengite* is the iron-rich end member of the variscite-strengite series, ibid. p. 756.

San Diego County: 1, A violet-colored material from Pala, probably the one called strengite by Schaller (29) p. 145, has been identified by x-ray study as phosphosiderite, C. Frondel (p.c. '48). It is associated with yellow stewartite, and oxides of manganese.

METAVOLTINE

$(H,K)_4(FeOH)_2(SO_4)_4 \cdot 5H_2O$

Hexagonal. In aggregates of minute yellow scales. H. = 2½. G. = 2.5. Soluble in acid. Partly soluble in water.

San Bernardino County: 1, Foshag (19) p. 352, has found metavoltine with krausite, coquimbite, alunite, and other sulphates at the "sulphur hole" just below the borate mines near Borate, in the Calico Hills.

METEORITE

See iron

* MEYERHOFFERITE, 1914

Hydrous calcium borate, $Ca_2B_6O_{11} \cdot 7H_2O$

Triclinic. Long prismatic crystals, sometimes tabular parallel to the macropinacoid. Fibrous. One cleavage. Vitreous luster. Colorless to white. H. = 2. G. = 2.12.

Fuses readily with intumescence to an opaque white enamel, giving the green flame of boron. Gives water in a closed tube. Easily soluble in acids.

Inyo County: 1, Meyerhofferite occurs as an alteration of the glassy inyoite crystals in the colemanite deposit of the Mount Blanco district on Furnace Creek. It was described, analyzed, and named by Schaller (33) p. 35. Other references are Foshag (7) p. 200, (10) p. 10.

Analysis

CaO	B_2O_3	H_2O under 110°	H_2O above 110°
25.45	46.40	1.01	27.75 = 100.16%

MIARGYRITE

Silver antimony sulphide, $AgSbS_2$

Monoclinic. In complex crystals; also massive. Luster metallic-adamantine. Color iron black to steel gray, in thin splinters deep blood red. Streak cherry red. H. = 2-2½. G. = 5.1-5.3.

San Bernardino County: 1, Miargyrite is probably the most abundant silver mineral in the deposits of the Randsburg district. Well-formed crystals are found in open drusy cavities in the veins, Hulin (1) pp. 97, 98. Shannon (7) pp. 1-10, has described and analyzed crystals from the California Rand silver mine. Murdoch (9) p. 773 has also studied complex crystals from this occurrence.

MICA

See biotite; muscovite; lepidolite; phlogopite

MICROCLINE

See feldspar

MICROLITE

Tantalate of calcium, $Ca_2Ta_2O_7$

Isometric. Often small octahedrons. Brittle. Luster resinous. Color pale yellow to brown. H. = 5½. G. = 5.5.

The reactions are similar to those for pyrochlore. Fused with potassium bisulphate or potassium hydroxide, the fusion dissolved in hydrochloric acid, the solution boiled down with tin assumes a deep-blue color.

Riverside County: **1,** Rare microlite occurs on Queen Mountain, Pala, Jahns and Wright (5) p. 31. This may be the same locality referred to by Rogers (7) p. 375. **2,** Microlite is reported from the Fano mine, with lepidolite and quartz, Dana's *System of Mineralogy,* Vol. I, 7th Ed. p. 753.

San Diego County: **1,** Microlite has been found in the county, exact locality unknown, as a honey-yellow mineral associated with albite, lepidolite, tourmaline, and colorless apatite. A few crystals are octahedral with narrow modifying faces, A. F. Rogers (7) p. 375.

MILK OPAL

See opal

MILLERITE

Nickel sulphide, NiS

Hexagonal-rhombohedral. Usually in long slender needles and hair-like tufts. Cleavage perfect prismatic. Brittle. Metallic luster. Color pale brass yellow. Streak greenish black. H. = 3-3½. G. = 5.3-5.65.

Roasted on charcoal, it yields a slight odor of sulphur and leaves a magnetic residue. The roasted residue fused in a bead of borax, will give a brown bead, which becomes gray and cloudy, when reduced. Produces a pale-blue solution when dissolved in nitric acid and ammonia added.

Humboldt County: **1,** Specimens of serpentine from this county occasionally contain needles of millerite (N. R.).

Lake County: **1,** Millerite occurs in the Great Western mine, in very small amount, Yates and Hilpert (4) p. 246.

Napa County: **1,** Small coatings of microscopic crystals of millerite were found with cinnabar at the Andalusia mine near Knoxville, Becker (4) p. 284. **2,** Minute millerite crystals were found at the Aetna mine (sec. 2, T. 9 N., R. 6 W., M. D.), Becker (4) p. 372, (6) p. 148. **3,** Millerite was found at the Oat Hill mine in Pope Valley (N. R.). **4,** Specimens of serpentine containing needles of millerite have come from Berryessa Valley (N. R.). **5,** Slender needle-like crystals which may be millerite were found in microscopic sections from the Redington mine, Becker (4) p. 286, A. F. Rogers (35) p. 396. **6,** Millerite is found in the Twin Peaks mine, Yates and Hilpert (4) p. 246.

Placer County: **1,** It was found with arsenopyrite near Cisco, Hanks (12) p. 264.

Plumas County: **1,** Millerite occurred as coatings in the Pocahontas mine, Mountain Meadow district, Crawford (1) p. 69.

San Luis Obispo County: **1**, Bronze needlelike crystals of millerite up to ½ inch in length, occur in the ore of La Libertad mine, Adelaide district, sec. 21, T. 27 S., R. 10 E., M. D., F. F. Davis (p. c. '53).

Ventura County: **1**, Millerite has been found with pyrrhotite and pentlandite at the Ventura mine (T. 1 N., R. 18 W., S. B.), Tucker and Sampson (20) p. 258.

MILOSCHITE

See kaolinite

MIMETITE

Lead chloro-arsenate, $(PbCl)Pb_4(AsO_4)_3$

Hexagonal. Prismatic crystals, rounded to globular forms. Brittle. Resinous luster. Pale yellow, light brown, colorless. Streak white. H. = 3½. G. = 7-7.25.

Fusible. Using sodium carbonate as flux, it is reduced on charcoal to metallic lead and gives a yellow coating. Powder heated in a closed tube with a splinter of charcoal above it, becomes reduced to metallic arsenic, which forms a ring around the walls of the glass. Gives a slight chlorine reaction with nitric acid and silver nitrate. Soluble in nitric acid.

Inyo County: **1**, Mimetite is one of the numerous minerals occurring in the Cerro Gordo mines, Irelan (4) p. 47. **2**, It is found in the Blind Spring Hill district, Loew (1) p. 657. **3**, Well-crystallized specimens have come from the Anaconda mine at Darwin, Noren (p.c. '54). **4**, Occurs sparingly in small greenish crystals in the ores of the Minietta Mines, Argus Range. Woodhouse (p.c., '54).

Kern County: **1**, It was found with galena near Randsburg (N. R.).

San Bernardino County: **1**, Small amounts of mimetite were found in the Morning Star mine, Lava Beds district, near Lavic, S. M. B. (11394). **2**, A specimen of very pale mimetite, associated with pale wulfenite, in the University of California collections at Berkeley, is probably from the Vanadium King mine near Goffs.

MINERVITE

See taranakite

MINIUM—Red Lead

Lead oxide, Pb_3O_4

Powder. Dull luster. Color bright red mixed with yellow. Streak orange yellow. H. = 2.3. G. = 4.6.

Gives a yellow coating of lead oxide on charcoal and is reduced by sodium carbonate to metallic lead.

The red oxide of lead is rarely found native. It is an oxidation product of galena and other lead minerals, occurring as a powder.

Inyo County: **1**, Abundant minium was reported from Cerro Gordo, with massicot, wulfenite, and pyromorphite, R. W. Raymond (9) pp. 29, 31.

Kern County: **1**, Minium has been found near Fort Tejon (N. R.).

Los Angeles County: **1**, Minium occurs as vivid red coatings on galena, with barite and fluorite in the Felix fluorite mine near Azusa, Clarke (p. c., '36).

Mono County: **1**, It has been recorded from the Rockingham mine, Blind Spring Hill district, Hoffman (1) p. 737.

San Bernardino County: **1**, It has been reported from the Bullion mine, probably in this county (T. 10 N., R. 1 E., or T. 14 N., R. 15 E., S. B.). The location is doubtful.

Tulare County: **1**, Minium is reported from the northern part of the county, Irelan (4) p. 47, S. M. B. (11420).

MIRABILITE—Glauber Salt

Hydrous sodium sulphate, $Na_2SO_4 \cdot 10H_2O$

Monoclinic. Generally as crusts and efflorescences. One perfect cleavage. Vitreous luster. Color white. H. = 1½-2. G. = 1.48.

Gives an intense yellow flame when heated. Gives much water in a closed tube. Very soluble in water. Barium chloride precipitates barium sulphate from solution. Taste salt and bitter.

Mirabilite is sometimes found on the walls of mines where sulphide ores are decomposing. It is also found as crusts about dry alkali lakes.

Imperial County: **1**, Mirabilite occurs with thenardite at Pope Siding (sec. 19, T. 9 S., R. 12 E., S. B.), Tucker (8) p. 87.

Napa County: **1**, It occurred on the walls of the tunnels in the old Redington cinnabar mine, Knoxville (N. R.).

San Bernardino County: **1**, Mirabilite occurs with gypsum and halite in the Chemahuevis Valley about 32 miles south of Needles, Graeff (1) p. 173. It is found here only by analysis of the soluble constituents of the clay. **2**, It is abundant at Searles Lake, H. S. Gale (13) p. 297.

San Luis Obispo County: **1**, It occurs with blödite in the white crystalline salts of Soda Lake (T. 31 S., R. 20, 21 E., M. D.), which receives the drainage of Carrizo Plain, H. S. Gale (10) p. 430, Franke (2) p. 455.

MOHAVITE

See tincalconite

MOLYBDENITE

Molybdenum disulphide, MoS_2

Hexagonal. Usually in scales and foliated masses. Cleavage perfect basal. Metallic luster. Color lead gray. Streak bluish to greenish gray. H. = 1-1½. G. = 4.7-4.8.

Fusible, giving sulphur odor. Soluble in nitric acid. Readily distinguished from graphite, which it closely resembles, by the violet color shown in a cleavage crack.

Molybdenite is the principal ore of molybdenum. The mineral is widely distributed in the state, occurring in small flakes and leaves in quartz veins and granites. It strongly resembles graphite but can generally be distinguished from that mineral by its lighter bluish lead-gray color and its occurrence with granitic rocks. It is of very common occurrence in contact-metamorphic tungsten ores.

Amador County: **1**, It occurs in the gold ores of the Zeila mine near Jackson, F. L. Ransome (9) p. 8, A. Knopf (11) p. 39. **2**, In the Argonaut mine, Josephson (1) p. 475, **3**, the Badger mine near Sutter, and **4**, Midian mine near Herbertville, J. B. Trask (7) pp. 35, 36.

Calaveras County: **1**, It is common in the ores of the Melones mine, Carson Hill, A. Knopf (11) p. 39. **2**, It occurs at Garnet Hill, at the junction of Moore Creek and Mokelumne River, Melhase (6) p. 7. **3**, It is found in sulphide-rich gold ore at the Hale mine near Angels, J. A. Brown (1) p. 147.

El Dorado County: **1,** Broad foliated plates of molybdenite occur in a pegmatite with axinite and copper sulphides at the old Cosumnes mine near Fairplay, Hanks (12) p. 274. **2,** Plates of molybdenite are found at Grizzley Flat, Mining and Scientific Press (37) p. 420, S. M. B. (15183). **3,** J. B. Trask (7) p. 28, reported it from the Pacific mine at Placerville.

Fresno County: **1,** Molybdenite is found at the Kings River Canyon copper mine, S. M. B. (16296). **2,** Good broad plates occur at Green Mountain on the South Fork, San Joaquin River, S. M. B. (14832). **3,** It is reported with ferrimolybdite near Palisade Creek (T. 10 S., R. 31, 32 E., M. D., approx.), W. W. Bradley (24) p. 345.

Inyo County: **1,** Large masses of molybdenite occur in the Pine Creek tungsten mine, south slope of Mount Morgan, Tucker (4) p. 296. **2,** It is found in a 15-inch vein with quartz at the Lucky Boy prospect, 7 miles east of Kearsarge. **3,** A considerable deposit is reported south of Lida, in the west arm of Death Valley, Engineering and Mining Journal (9) p. 205. **4,** It occurs disseminated in granite at the Coso molybdenite claim (T. 20 S., R. 38 E., M. D.), Tucker and Sampson (25) p. 459. **5,** Foliated molybdenite came from the Beveridge mine, Hanks (12) p. 274. Many other minor occurrences are found in the county: **6,** Panyo tungsten (T. 20 S., R. 40 E., M. D.), W. W. Bradley (30) p. 671; **7,** Wilshire gold mine, A. Knopf (6) p. 236; **8,** Deep Creek west of Bishop, Hess and Larsen (17) p. 269; **9,** Breakneck Canyon, The Mineralogist (5) p. 10; **10,** 2½ miles east of Willow [Wilson?] Springs, Funeral Range, S. M. B. (21022); **11,** In the Payute and Benton districts, Loew (2) p. 186.

Kern County: **1,** Molybdenite is a minor mineral in the scheelite deposits around Hobo Hot Springs and Cedar Creek, Prout (1) p. 413, Hess and Larsen (17) p. 266. **2,** It occurs in the Gorman district, with cassiterite and powellite, Page and Wiese (1) p. 36. **3,** It is largely altered to powellite at Black Mountain, 15 to 20 miles northwest of Randsburg, Hess (14) p. 48. **4,** It is abundant in the Amalie district, Mining and Scientific Press (35) p. 868. **5,** Disseminated grains of molybdenite occur in granite between Hoffman and Butterbread Canyons, Murdoch (p.c. '50).

Los Angeles County: **1,** Minor amounts of molybdenite have been found in the Winter Creek group, Santa Anita Canyon, R. J. Sampson (10) p. 176. **2,** Lang Canyon, 6 miles north of Altadena, Tucker (13) p. 318. **3,** At the junction of Coldwater and Franklin Canyon Roads, Santa Monica Mountains, Neuerberg (p.c. '46), **4,** Coarse flakes of molybdenite occur in quartz and feldspar on the north side of Big Tujunga Canyon, 2 or 3 miles above its mouth, Murphy (p.c. '49).

Madera County: **1,** Molybdenite occurs at Speckerman's mine, 6 miles above Fresno Flat, Hanks (12) p. 274. **2,** A small deposit is found at Sugar Pine, R. P. McLaughlin and Bradley (3) p. 559. **3,** It occurs in cavities in quartz with ferrimolybdite, on the west slope of Red Top Mountain on the Minaret-Kings Creek trail, Erwin (1) p. 71.

Mariposa County: **1,** A little molybdenite occurs in a lens of garnet, epidote, and quartz on the southeast slope of Mount Hoffman, Turner (19) p. 426. **2,** It is found with ferrimolybdite in the Kinsley mining district, 7 miles from El Portal (N. R.).

Mono County: **1**, It is found in a number of localities in the Sweetwater Range, north of Bridgeport, Whiting (1) p. 362, Pratt (4) pp. 199, 265, Boalich (4) p. 154. **2**, It also occurs on Bloody Mountain, above Laurel Lakes, Mayo (4) p. 83.

Monterey County: 1, Abundant molybdenite was found in a series of quartz veins on the Westcott ranch, 8 miles east of Soledad, Boalich (4) p. 157.

Nevada County: **1**, Molybdenite occurs sparingly in the Grass Valley and Nevada City areas, Lindgren (12) p. 119, W. D. Johnston, Jr. (4) p. 39.

Placer County: **1**, It is abundant in some of the mines of the Ophir district, Lindgren (7) p. 273.

Plumas County: **1**, Some high-grade molybdenite ore was produced near Chilcoot, E. M. Boyle (2) p. 180.

Riverside County: **1**, Molybdenite occurs with other sulphides in shear zones of quartz, at the southeast base of Mt. Hole (sec. 10 ? , T. 3 S., R. 6 W., S. B.), Larsen (17) p. 96. **2**, Occurs in the sheeting planes of an aplitic granite 3½ miles NE of Corona, east of the small gulch that heads east of Mt. Hole. Larsen, E. S., Jr., Everhart, D. L., Merriam, Richard (18) p. 49.

San Bernardino County: **1**, There are several small occurrences of molybdenite on the South Fork of Lytle Creek, Tucker (4) p. 356, Tucker and Sampson (16) p. 266. **2**, It occurs with wolframite and hübnerite in the New York Mountains (sec. 35, T. 14 N., R. 15 E., S. B.), Tucker and Sampson (30) p. 584, (34) p. 497. **3**, Strongly fluorescing molybdenite is found in garnet-epidote contact zones, NE¼ sec. 32, T. 3 N., R. 2 E., S. B., Gillou, (p.c. '50).

San Diego County: **1**, A large deposit of molybdenite in granite occurs near Campo (sec. 8, T. 18 S., R. 5 E., S. B.), Orcutt (1) p. 71, Tucker (4) p. 379. **2**, Molybdenite occurs in quartz veins 4 miles southeast of Dulzura, on the north side of Cottonwood Creek, Engineering and Mining Journal (22) p. 1017, Tucker (4) p. 380. **3**, It occurs as masses and flakes in aplite (secs. 3, 11, T. 13 S., R. 1 W., S. B.), 6 miles west of Ramona, Calkins (1) p. 73. **4**, It occurs with pyrrhotite at the Echo mine near Lakeside, W. W. Bradley (28) p. 495, S. M. B. (20948).

Shasta County: **1**, A considerable deposit of molybdenite in aplite or alaskite, is found on Boulder Creek (sec. 33, T. 37 N., R. 5 W., M. D.), F. McN. Hamilton and Root (5) p. 126, Averill (9) p. 168. See also J. B. Trask (7) p. 50.

Sierra County: 1, Molybdenite was found with molybdite in copper ore at the Sierra Buttes mine, Burkart (2) p. 21, J. R. Browne (4) p. 210.

Siskiyou County: **1**, Molybdenite and chalcopyrite have been recorded from the Yellow Butte mine (sec. 25, T. 43 N., R. 4 W., M. D.), Averill (5) p. 273. **2**, It was found in a quartz vein with gold and tetradymite at the Quartz Hill mine (sec. 16, T. 45 N., R. 10 W., M. D.), Averill (p.c. '45).

Trinity County: **1**, It was found with ferrimolybdite near Lewiston, S. M. B. (19433).

Tulare County: **1**, Molybdenite occurs with ferrimolybdite in the Mineral King district (T. 16 N., R. 31 E., M. D., approx.), Laizure (2) p. 47. **2**, Fine large foliated plates of molybdenite occur in granodiorite

at the head of Kaweah River, F. McN. Hamilton and Root (5) p. 126. **3,** It has been reported from Cow Mountain, Hot Springs district, Engineering and Mining Journal (16) p. 228.

Tuolumne County: **1,** Molybdenite with pyrite in a quartz vein occurs on the south side of Knights Creek, near Big Trees, Turner (12) p. 707, Turner and Ransome (18) p. 8. **2,** In quartz veins with epidote and garnet, 3 miles west of Tower Peak (secs. 16, 17, T. 3 N., R. 15 E., M. D.) Logan (23) p. 81, Turner (19) p. 427. **3,** A good specimen has come from the Norwegian mine, S. M. B. (19525).

Ventura County: **1,** Small kidneylike deposits of molybdenite, with copper minerals, occur on Frazier Mountain (sec. 11, T. 6 N., R. 19 W., S. B.), Tucker and Sampson (20) p. 257. **2,** On McDonald Peak (Alamo Mountain), Pratt (4) p. 266, Tucker and Sampson (20) p. 257.

Yuba County: **1,** Plates of molybdenite with yellow ferrimolybdite have been reported near Camptonville (N. R.).

MOLYBDITE

See ferrimolybdite

MONAZITE

Phosphate of the rare earths, $(Ce,La,Pr,Nd)PO_4$

Monoclinic. Crystals rare. Commonly as grains in sands. One perfect cleavage, another poor. Brittle. Vitreous to resinous luster. Color yellowish brown, sometimes reddish. H. = 5-5½. G. = 5.0-5.2.

B.B. infusible. Fused with sodium carbonate and the fusion dissolved in nitric acid, the solution will give a lemon-yellow precipitate on addition to ammonium molybdate. Decomposed by concentrated sulphuric acid, and the solution treated with ammonium oxalate, the rare earth metals cerium, lanthanum, etc., will be precipitated.

Minute grains are not uncommon in small amounts in beach and river sands of the state. Other occurrences are in pegmatites.

Small amounts have been found in the sands of Butte, El Dorado, Humboldt, Nevada, Placer, Plumas and Yuba Counties, D. T. Day and Richards (7) pp. 1185, 1186, 1187, Lindgren (20) p. 74.

Del Norte County: **1,** It was observed in the black sands at Crescent City in amounts up to 56 pounds per ton of concentrates, D. T. Day and Richards (7) p. 74.

Riverside County: **1,** Monazite in small crystals associated with xenotime and cyrtolite is a conspicuous constituent of a pegmatite in the Southern Pacific silica quarry near Nuevo, Dykes (1) p. 161, Melhase (7) p. 11. **2,** It is also found in pegmatites, about 2 miles north of Winchester, W. W. Bradley (23) p. 117. **3,** Just east of Riverside, at the foot of the Box Springs Mountains, Dykes (1) p. 161. **4,** Crystals of monazite have been found with albite in a pegmatite, about 200 yards west of the Jensen limestone quarry in the Jurupa Mountains, J. W. Clark (p.c. '36). It seems probable that the monazite crystals reported from west of the Jensen quarry are sphene instead, as this mineral is abundant there, Murdoch (p.c. '47). **5,** Rosettes of monazite (?) have been found with rose quartz in the Williamson silica mine (sec. 20, T. 7 S., R. 2 E., S. B.), Fisher (1) p. 54. **6,** Monazite has been reported from fine-grained granite, on the west side of Mt. Rubideaux, Larsen (p.c. '46). **7,** Monazite has been reported as a minor constituent of tonalite, together with anatase and zircon, from a tunnel south of

Val Verde, R. W. Wilson (1) p. 124. **8,** The Mountain View pegmatite has yielded small crystals of monazite, Murdoch (p.c. '54). **9,** Monazite is reported from a pegmatite in the magnesite mine near Winchester, Chesterman (5), p. 362.

San Bernardino County: **1,** Monazite occurs in crystals and grains in the bastnaesite deposit at Mountain Pass, Olson (2), quoted in Wright et al. (5) p. 125. **2,** Monazite, with ilmenite, allanite and euxenite, is found in the borders of the quartz nucleus of the pegmatite in the Pomona Tile quarry, on the road between Old Woman Spring and Yucca Valley, Hewett and Glass (3), p. 1048.

San Diego County: **1,** Occasional well-developed monazite crystals, often enclosed in garnet occur in the old Garnet Ledge (center sec. 19, T. 11 S., R. 2 E., S. B.) at Mesa Grande, ibid. p. 144, Fisher (1) p. 144. **2,** Monazite has been reported from the A.B.C. mine, Ramona, Dawson (p.c. '50). **3,** Crystals as much as half an inch in size have been found in the Katerina mine, Hiriart Mountain, Pala, Jahns and Wright (5), p. 31.

MONTICELLITE

Calcium and magnesium silicate, $CaMgSiO_4$

Orthorhombic. In small crystals or grains. One distinct cleavage. Brittle. Vitreous luster. Colorless to gray. Streak uncolored. H. = 5-5½. G. = 3.03-3.25.

Almost infusible, but soluble with gelatinization. Magnesium can be precipitated from a solution after all silica and calcium have been removed.

Monticellite is a rare mineral formed by contact metamorphism in magnesian limestone.

Riverside County: **1,** Monticellite is one of the many minerals occurring in the crystalline limestone at Crestmore. It was found massive, A. F. Rogers (46) p. 192, and in isolated grains in the blue calcite, associated with xanthophyllite, Eakle (14) p. 335, (15) p. 342. Woodford et al. (10) p. 365 report rare prisms up to 8 centimeters in length. Moehlman and Gonyer (1) p. 474 describe the occurrence of monticellite with garnet and diopside at Crestmore.

San Bernardino County: **1,** It occurs as very pure round greenish granular masses in metamorphosed dolomite at the Dewey mine in the Clark Mountain district, 6 miles east of Valley Wells, Schaller (50) p. 815.

MONTMORILLONITE—Saponite, Hectorite

Hydrous magnesium, calcium, and aluminum silicate, $(Al,Mg)_8(Si_4O_{10})_3(OH)_{10}\cdot 12H_2O$

Massive, clay-like. Perfect basal cleavage. Luster feeble. Color white to rose red. Very soft. G. = 2.

The clay known as *bentonite* which has been derived from the alteration of volcanic ash or tuff, is usually composed of montmorillonite.

Inyo County: **1,** Montmorillonite is mined under the name of "amargosite" along the Amargosa River, near Tecopa, Shoshone, and Ash Meadows, Melhase (2) p. 838. Montmorillonite from Amargosa Valley was analyzed by Fairchild, R. C. Wells (3) p. 101.

Kern County: **1,** A fullers earth deposit, largely bentonite, has been developed 5 miles southeast of Tehachapi Pass, Kerr and Cameron (4) p. 231. **2,** It has been reported from Bissell, W. W. Bradley (30) p. 602.

Los Angeles County: **1**, Waxy montmorillonite, apparently formed by the alteration of feldspar, occurs in an abandoned quarry in pegmatite, 2 miles north of Claremont, Laudermilk and Woodford (3) p. 260; analyzed by Laudermilk.

Riverside County: **1**, Soft white clay-like montmorillonite occurs with prehnite on the 700-foot level below the Chino quarry, Crestmore, Woodford et al. (10) p. 372.

San Bernardino County: **1**, Large deposits of montmorillonite are reported about 7 miles east of Barstow on the north side of the Mojave River, Melhase (2) p. 837, C. W. Davis and Vacher (1) p. 6. **2**, Magnesium-rich bentonite, locally called hectorite is found between Barstow and Ludlow beyond Newberry Springs, Foshag and Woodford (22), p. 238. This may be the same locality as **1**. The bentonitic magnesian clay mineral described by Foshag and Woodford (22) p. 242 from a quarry 3½ miles south of Hector (secs. 26, 27, T. 8 N., R. 6 E., S. B.), is probably saponite.

Saponite from Hector has also been analyzed (a) by Fairchild and (b) by Stevens, R. C. Wells (3) p. 110.

San Diego County: **1**, Fairchild analyzed: (a) Montmorillonite from this county; (b) pink montmorillonite from pegmatite from this county, R. C. Wells (3) p. 107. [probably from Pala or Mesa Grande.] **2**, Under the local name of "otaylite," commercial shipments of montmorillonite have been made from a deposit 3 miles southeast of Otay, Irelan (4) p. 139, Hertlein and Grant (1) p. 57, Kerr (7), p. 51.

Ventura County: **1**, Montmorillonite is the essential constituent of the bentonite clay beds on the west bank of the Ventura River 2 miles south of the Ventura Avenue oil field, along Los Sauces Creek 2 miles north of the Rincon oil field. **2**, At the mouth of Rincon Creek. **3**, Near Oakview, Kerr (1) p. 157.

MONTROYDITE

Mercuric oxide, HgO

Orthorhombic. Prismatic crystals. One perfect cleavage. Brilliant luster. Color and streak deep-red. H. = 1½-2.

Volatile.

Lake County: **1**, Montroydite has been found at the Red Elephant mine, near Lower Lake, W. W. Bradley (26) p. 608.

San Mateo County: **1**, Montroydite has been found in long prismatic and bent crystals with eglestonite, calomel, native mercury, and cinnabar in joints and fissures in a siliceous rock replacing serpentine about 2 miles west of Redwood City, Woodhouse (3) p. 603.

Sonoma County: **1**, Montroydite, with mercury and cinnabar has come from the Esperanza mine, Sulphur Creek, W. W. Bradley (26) p. 608.

MOONSTONE

See feldspar, orthoclase

MORENOSITE

Hydrous nickel sulphate, $NiSO_4 \cdot 7H_2O$

Orthorhombic. In acicular crystals; fibrous, as an efflorescence. One perfect cleavage. Vitreous luster. Color apple green to greenish white. H. = 2-2½. G. = 2.

Fused in a borax bead, gives the brown of nickel in the oxidizing flame, which becomes gray and cloudy in the reducing flame. Gives off acid water in a closed tube. Soluble in water giving a metallic taste.

Napa County: **1**, Morenosite was said by Becker (4) p. 389, to coat a specimen of millerite from the Phoenix cinnabar mine.

San Diego County: **1**, Morenosite occurs with limonite and erythrite in the oxidized part of the ore in the Friday copper mine, near Julian, Hudson (1) p. 214.

Trinity County: **1**, It has been found with associated secondary minerals at the Island Mountain copper mine, Landon (1) p. 279.

MORGANITE

See beryl

MOSS OPAL

See opal

MOUNTAIN CORK

See amphibole group, tremolite

MOUNTAIN LEATHER

See amphibole group, tremolite

MUSCOVITE—Potash Mica

Hydrous potassium and aluminum silicate, $(K,Na)(Al,Mg)(Si,Al)_4O_{10}(OH)_2$

Monoclinic. Hexagonal-shaped plates, plumose aggregates, scales, compact massive. Cleavage perfect basal. Vitreous luster. Colorless, gray, brown, pale green, yellow, pink. Streak uncolored. H. = 2-2½. G. = 2.76-3.

Very difficult to fuse. A little of the powder taken on a platinum wire and moistened with sulphuric acid will give the violet flame of potassium when held in the colorless Bunsen flame. A small amount of moisture is obtained by intense heating in a closed tube. Insoluble in acids.

Sericite = *margarodite* = *damourite*, is a fine-grained, greasy-feeling muscovite forming sericitic schists. Sericite is common in the Mother Lode mines, and a good general description of its occurrence is given by A. Knopf (11) p. 40. ***Fuchsite*** is an emerald-green chrome-muscovite. *Agalmatolite* is in part a grayish compact or altered muscovite, and in part a compact pyrophyllite.

Muscovite is a common constituent of granites, pegmatites, gneisses, and schists. It is generally called mica or isinglass, and is of economic value when in large transparent sheets. Extensive areas of mica schists occur in the state, in which muscovite is a principal constituent and gives the rock its schistose structure. Muscovite is so widespread that only the most interesting occurrences can be listed.

Imperial County: **1**, A very large deposit of nearly pure sericite has been worked by the Western Non-Metallic Company in the Cargo Muchacho Mountains, 4 miles northeast of Ogilby. It is associated with kyanite, R. J. Sampson and Tucker (18) p. 139.

Marin County: **1**, Much of the material called margarite in the schists near Reed Station has been shown to be muscovite, Eakle (7) p. 83.

Orange County: **1**, The variety fuchsite has been found at Arch Beach. **2**, A specimen of chrome mica (fuchsite) was found among the beach pebbles at San Juan Capistrano, Irelan (4) p. 46, Preston (1) p. 210.

San Bernardino County: **1**, Fuchsite occurs in the schist at Cascade Canyon, near the lapis lazuli locality, Merriam and Laudermilk (1) p. 716. **2**, The "alurgite" described by Webb (6) p. 124 from boulders and pebbles of quartz-mica schist, with piedmontite, from the alluvial gravels just north of Cajon Pass, and west of the highway is shown to be ferrian muscovite, Heinrich and Levinson (2) p. 41.

San Diego County: 1, Reasonably well-formed crystals of muscovite from the Mack mine, Rincon, have been measured by A. F. Rogers (4) p. 214. 2, Muscovite carrying small amounts of cesium and rubidium has been analyzed from Pala, Stevens and Schaller (3) p. 526. 3, A. F. Rogers (3) p. 19, has observed pseudomorphs of muscovite after tourmaline at Pala. 4, Muscovite pseudomorphs after radiating clusters of dumortierite have been found near Alpine, Murdoch (p. c., '45).

Sierra County: 1, Margarodite has been found at Table Rock, S. M. B. (16290).

Trinity County: 1, A large deposit of muscovite has been reported from the Salmon Mountains, Clarke (3) p. 911.

Ventura County: 1, Sheets of muscovite up to 10 inches across have been shipped from a pegmatite on Mount Alamo (sec. 12, T. 7 N., R. 20 W., S. B.), Sterrett (3) p. 743, (11) p. 48.

MYRICKITE

See quartz, chalcedony; opal; cinnabar

NAGYAGITE

Sulpho-telluride of lead and gold, $Pb_5Au(Te,Sb)_4S_{5-8}$

Orthorhombic. Generally foliated and granular massive. Perfect cleavage into thin flexible laminae. Metallic luster. Color and streak dark lead gray. H. = 1-1½. G. = 6.85-7.2.

Gives the yellow and white coatings of lead and tellurium oxides, when roasted on charcoal, with a light odor of sulphur. The presence of tellurium can best be tested by boiling in sulphuric acid and obtaining the violet color.

Calaveras County: 1, Nagyagite has been tentatively reported from the Stanislaus mine, J. D. Whitney (7) p. 263.

Shasta County: 1, A sulpho-telluride of lead has been doubtfully reported from Sugar Loaf, 3 miles south of Mount Pleasant, C. J. O'Brien (1) p. 349.

Trinity County: 1, Nagyagite was observed with hessite at the Dorleska mine (sec. 16 ?, T. 38 N., R. 9 W., M. D.), Coffee Creek district, Hershey (2) p. 689, Osborne (1) p. 252, Stines (1) p. 25.

NAHCOLITE

Sodium bicarbonate, $NaHCO_3$

Monoclinic. Square prisms, diagonally terminated. Cleavages, one perfect, another good. Colorless to white, soluble in water, yielding an alkaline solution. Fuses quietly to a white crystalline bead, and colors the flame intense yellow. G. = 2.22.

San Bernardino County: 1, Large amounts of nahcolite have been found as pockets or thin beds in the Searles Lake deposit, at depths of 120 to 285 feet below the surface, Foshag (26) p. 769.

* NAPALITE, 1888

A hydrocarbon, C_3H_4

Dark reddish-brown bituminous substance found with cinnabar. Brittle. Resinous luster. H. = 2. G. = 1.02.

Napa County: 1, Napalite occurred with pyrite and millerite at the old Phoenix cinnabar mine, Pope Valley, and was described by Becker (4) p. 372, with analyses by Melville. 2, It was found also at the Silver

Bar mine, S. M. B. (13935). **3,** Napalite is reported from the Aetna mine, Yates and Hilpert (4) p. 247.

Analyses

C	H
89.84	10.17 = 100.01%
89.54	10.36 = 99.90%
89.35	10.11 = 99.46%

Sonoma County: **1,** It has been found at Skaggs Springs, W. W. Bradley (24) p. 345, S. M. B. (20814).

NASONITE

A lead, calcium chlorine silicate, near $Pb_4(PbCl)_2Ca_4(Si_2O_7)_3$

Hexagonal, crystals simple prism and base. Massive, granular, coating. H. = 4. G. = 5.42. Luster greasy. Color white, bluish white, yellow, orange.

Closely related to ganomalite, but with chlorine instead of hydroxyl.

Riverside County: **1,** Thin coatings of massive nasonite, with a few recognizable crystals, appear on fracture surfaces in compact garnet-wollastonite rock in the contact zone, 910-foot level of the Commercial quarry, Crestmore, Murdoch (28) p. 1341. The color varies, probably due to minor differences in composition, is sometimes yellow, sometimes blue-green.

NATROALUNITE

See alunite

NATROLITE

Hydrous sodium and aluminum silicate, $Na_2Al_2Si_3O_{10} \cdot 2H_2O$

Orthorhombic. Prismatic crystals. Long needles, columnar, fibrous, radiating, massive. Cleavage perfect prismatic. Vitreous luster. Colorless to white. H. = 5-5½. G. = 2.20-2.25.

Fuses quietly to a clear glass and gives the yellow flame of sodium. Soluble in hydrochloric acid and yields much jelly on evaporation. Gives water in a closed tube.

Natrolite is a zeolite formed as a secondary mineral in cavities of igneous rock and sometimes as veins in such rock. It usually occurs fibrous or acicular, associated with stilbite and other zeolites.

Alameda County: **1,** Needles of natrolite occur with analcime in the amygdules of the andesitic rock in the Berkeley Hills, Lawson and Palache (4) p. 417.

Fresno County: **1,** It occurs as an alteration product of soda-nepheline at the head of White Creek, Arnold and Anderson (8) p. 158.

Inyo County: **1,** Foshag (10) p. 10 reports the occurrence of natrolite in radiating groups with analcime in cavities in lava near the Russell borax mine, Mount Blanco district.

Kern County: **1,** Fibrous bunches of natrolite occur with analcime in small cavities in a lava flow at Red Rock Canyon, Baker (2) p. 125, Murdoch and Webb (14) p. 330.

Los Angeles County: **1,** Natrolite was found in vesicular basalts at the Pacific Electric quarry, Brush Canyon (sec. 35, T. 1 N., R. 14 W., S. B.), Neuerberg (1) p. 158. **2,** West of Cahuenga Pass with heulandite, Schürmann (1) p. 12, Funk (1) p. 34. **3,** As compact nodules with analcime at Lake Malibu, Schwartz (1) p. 414. **4,** Occurs as hairlike radiating crystals in amygdaloidal cavities in lava at the head of Tick Canyon, near Lang, Anon. (20), p. 382; Armstrong and Van Amringe (1). **5,**

Amygdules of natrolite, up to the size of a hen's egg are found west of Laurel Canyon, locality 8, Neuerburg (1) p. 158. **6,** Radiating needles in vesicles in basalt of Brush Canyon (locality 5), have the bases pink, changing to white out from the center, Neuerburg (1), p. 156.

Modoc County: **1,** Slender needles of natrolite occur with stilbite in the lava of this county, S. M. B. (10258).

Plumas County: **1,** It occurs in druses of pegmatite at Engels, Graton and McLaughlin (4) p. 18.

San Benito County: **1,** A large vein of white natrolite occurs near the headwaters of the San Benito River on the west side of the Diablo Range about 25 miles north of Coalinga, in which crystals of benitoite and neptunite are included. The natrolite is mostly granular, although some crystals occur. The occurrence has been described by Louderback and Blasdale (2) p. 153, (5) p. 357, with analysis by Blasdale. **2,** Unusually large and complex crystals were found in veins in serpentine near the headwaters of San Benito River (sec. 29, T. 18 S., R. 12 E., M. D.), Murdoch (15) p. 504. **3,** Well-crystallized natrolite has come from Clear Creek (sec. 12, T. 18 S., R. 11 E., M. D.), W. W. Bradley (p. c. '44).

San Luis Obispo County: **1,** It has been found in an analcime diabase on the north side of the Cuyama Valley, Fairbanks (12) p. 277.

Shasta County: **1,** Natrolite occurs with chabazite and tridymite in basalt near Round Mountain, Melhase (3) No. 6, p. 1.

Sierra County: **1,** It was found on Herkin's Ranch, north of Sierra (N. R.).

Sonoma County: **1,** It occurs in the rocks of the Sonoma Mountains, near Petaluma, (N. R.).

Ventura County: **1,** It occurs with analcime in cavities of an amygdaloidal lava at the Frazier Mountain borax deposit (T. 8 N., R. 21 W., S. B.), Bowers (2) p. 680, Gale (11) p. 439.

NATRON

Hydrous sodium carbonate, $Na_2CO_3 \cdot 10H_2O$

Monoclinic. Tabular crystals formed by the evaporation of waters from soda lakes. Brittle. Vitreous to earthy. White, gray, or yellow. H. = 1-1½. G. = 1.42-1.46.

Gives intensely yellow flame and alkaline reaction. Soluble in water and effervesces in acids.

Inyo County: **1,** Crystals of natron mixed with sodium bicarbonate are obtained by evaporating the water of Owens Lake, and other soda lakes. The waters of Owens Lake have been analyzed by Chatard (4) p. 75.

San Bernardino County: **1,** Natron has been found at Searles Lake, Gale (13) p. 297.

NAUMANNITE

Silver selenide, Ag_2Se

Isometric. Cubic crystals; massive or in thin plates. One perfect cleavage. Sectile and malleable. Color lead black, streak black. Luster metallic. H. = 2½. G. = 7.0.

Nevada County: **1,** Microscopic specks of naumannite have been found with petzite and hessite at the Idaho-Maryland mine, Grass Valley, C. F. Tolman (p. c. '37).

† NEOCOLEMANITE, 1911

See colemanite

NEOTOCITE

Hydrous manganese and iron silicate, $MnO \cdot SiO_2 \cdot nH_2O$

Amorphous. Dull luster. Color black to dark brown. H. = 3-4. G. = about 2.8.

Gives green bead of manganese when fused with sodium carbonate. Soluble in acid. Yields water in a closed tube.

What is called neotocite is in general a manganiferous opal, from which the manganese may sometimes be removed by solution, leaving a spongy framework of opal. Taliaferro and Hudson (3) p. 257 mention the appearance of veins of neotocite in the Sierra, but give no specific locality. The mineral has apparently been found at a few widely scattered places in the Coast Ranges, P. D. Trask et al. (4) p. 70.

Humboldt County: **1**, It has been found in the Charles Mountain deposit (sec. 2, T. 1 S., R. 4 E., H.), P. D. Trask et al. (4) p. 59.

Mendocino County: **1**, Found with bementite at the Thomas mine, 6 miles northeast of Redwood (N. R.). **2**, With inesite at the Mount Sanhedrin deposits (N. R.).

Riverside County: **1**, Some neotocite is present in the Elsinore area, P. D. Trask et al. (4) p. 83.

San Luis Obispo County: **1**, The principal ore mineral at the Johe Ranch mine (sec. 35, T. 30 S., R. 11 E., M. D.), is neotocite, P. D. Trask et al. (4) p. 59.

NEPHELINE—Nephelite

$(Na,K)AlSiO_4$

Hexagonal. Rough prisms, or massive, grains in syenitic rock. Cleavage poor. Colorless, white, gray. Luster vitreous to greasy. H. = 5.5-6. G. = 2.5-2.6. Readily fusible. Gelatinizes with acids. Distinguished from feldspar by greasy luster and lack of cleavage.

Inyo County: **1**, A constituent of syenite rock at contact with dolomite, at Tin Mountain in the Panamint Range, McAllister (1) p. 1961, (3).

NEPHRITE

See amphibole

NEPTUNITE

Sodium, potassium, iron, and manganese titano-silicate, $(Na,K)(Fe'',Mn'',Ti)Si_2O_6$

Monoclinic. Prismatic crystals. Cleavage prismatic, poor. Vitreous luster. Color black; in thin splinters, blood red. Streak cinnamon brown. H. = 5-6. G. = 3.19-3.23.

Fused with sodium carbonate, gives green bead of manganese. Insoluble in hydrochloric acid.

San Benito County: **1**, Black crystals of neptunite occur with benitoite in a natrolite vein in schist about 4 miles south of New Idria near the headwaters of the San Benito River, and were first described by Louderback and Blasdale (2) p. 150, (5) p. 354; analyses by Blasdale and later by W. M. Bradley (1) p. 16. Further notes on neptunite: Arnold (4) p. 312, W. E. Ford (5) p. 235, Schaller (20) p. 55, Buttgenbach (2) p. 325.

NESQUEHONITE

Hydrous magnesium carbonate, $MgCO_3 \cdot 3H_2O$

Orthorhombic. In prismatic crystals, usually united in radiating groups. Cleavage, perfect prismatic. Colorless to white. Transparent to translucent. H. = 2.5. G. = 1.84.

San Benito County: **1,** Nesquehonite is reported as occurring with hydromagnesite near the Florence Mack quicksilver mine, south of New Idria (N. R.).

NICCOLITE

Nickel arsenide, NiAs

Hexagonal. Crystals rare, usually massive. Brittle. H. = 5-5.5. G. = 7.78. Luster metallic, color pale copper red, tarnishing gray to blackish. Streak pale brownish black. Soluble in aqua regia.

Calaveras County: **1,** Niccolite was reported with tellurides, tellurium, and native gold in specimens from the Stanislaus mine, Küstel (2) p. 128.

NICKEL BLOOM

See annabergite

NICKEL-IRON

See awaruite

NICOLAYITE

See thorogummite

NITER—Saltpeter

Potassium nitrate, KNO_3

Orthorhombic. In silky tufts, incrustations. Cleavage, one perfect. Vitreous luster. Colorless. H. = 2. G. = 2.1.

Similar to soda niter in its reactions, but the flame is violet red, best seen through blue glass or the Merwin color screen. Salt taste.

Niter is even less common in nature than soda niter. Its occurrences in California are closely associated with the latter, but it has been reported from only a few places. In none of these occurrences is the mineral visible as such, but its presence is revealed by analysis.

Imperial County: **1,** A trace of niter has been observed near Volcano station, F. J. H. Merrill (1) p. 741. The occurrence along the former high levels of the Salton Sea is soda niter.

Inyo County: **1,** There are no authentically documented occurrences of niter in this county, although it has been reported with soda niter near Shoshone. The occurrences cited by Noble (4), are all sodium nitrate.

Kern County: **1,** A sample of potassium nitrate is said to have come from sec. 16, T. 32 S., R. 34 E., M. D., Mansfield and Boardman (4) p. 25.

Modoc County: **1,** Incrustations of niter have been found near Cedarville (N. R.)

Riverside County: **1,** G. E. Bailey (2) p. 169, mentions saltpeter as occurring in the desert northeast of Salton. **2,** Small amounts of potassium nitrate are found in salts from Mud Hill, Twentynine Palms, Noble (4) p. 31. **3,** A very little niter has been found with soda niter at the Vivet Eye area, in the extreme northeast corner of the county, Turner (28) p. 636.

San Bernardino County: 1, G. E. Bailey (2) p. 181, Phalen (2) p. 894, report niter in the Upper Canyon beds. All other nitrate occurrences in the county are apparently sodium nitrate.

NITRO-GLAUBERITE

See darapskite

NONTRONITE

See chloropal

* NORTHUPITE, 1895

Double carbonate of magnesium and sodium with sodium chloride, $MgCO_3Na_2CO_3NaCl$

Isometric. Octahedral crystals. Vitreous. White to yellow or gray. H. = 3½-4. G. = 2.38.

Easily fusible. Soluble in dilute acid. As far as is known, northupite occurs only in this state.

Lake County: 1, It occurs with gay-lussite and pirssonite in trona at Borax Lake, Vonsen (3) p. 22, Vonsen and Hanna (4) p. 103.

San Bernardino County: 1, The original discovery in 1895 at Searles Lake consisted of some small octahedrons of northupite. The mineral was named by Foote (1) p. 480. An analysis was made by Pratt (1) p. 123. Other references: Gale (13) p. 291, Foshag (21) p. 51.

Analysis

CO_2	Cl	SO_3	MgO	Na_2O	H_2O	insol.	O for Cl
35.12	14.10	0.08	16.08	36.99	0.72	0.22 = 103.31	— 3.16 = 100.15

† NUEVITE, 1946

See samarskite

OCTAHEDRITE

See anatase

OKENITE

Hydrous calcium silicate, $Ca_2(Si_4O_{10})\cdot 4H_2O$

Triclinic. Finely fibrous and acicular. Cleavage perfect in one direction. Pearly luster. Color snow white. H. = 4½-5. G. = 2.2-2.3.

Fuses to a glass and colors flame reddish. Soluble in hydrochloric acid with slight gelatinization. Gives water in a closed tube.

Riverside County: 1, Okenite occurs as an alteration product of wilkeite in the limestone at Crestmore, Eakle and Rogers (13) p. 266. Radiating botryoidal coatings of okenite occur on apophyllite as an alteration product of wilkeite. It also occurs associated with idocrase and xanthophyllite. Crystal forms and analysis were reported by Foshag in Eakle (15) p. 351.

OLIGOCLASE

See feldspar

OLIVINE—Chrysolite-Peridot

Magnesium and iron silicate, $(Mg,Fe)_2SiO_4$

Orthorhombic. Crystals flattened. elongated. Massive, compact, or granular; in embedded grains. Cleavage sometimes distinct. Brittle. Vitreous luster. Color olive green, grayish green. Streak uncolored. H. = 6½-7. G. = 3.27-3.37.

Usually infusible, but whitens when heated and may become magnetic if much iron is present. Soluble in hydrochloric acid yielding gelatinous silica upon evaporation.

Olivine is a rock-forming mineral which is practically limited to very basic eruptive rocks like diabase, basalt, andesite, gabbro, and peridotite. It occurs occasionally in clear green crystals large enough to cut into gems. It is so common in the basic igneous rocks, and in stream sands derived from them, that only the following occurrences seem worthy of mention.

San Bernardino County: **1**, Massive granular olivine forms the core of many of the volcanic bombs found at Siberia crater, near Amboy, Brady and Webb (1) p. 406. Ross, C. S., Foster, M. D., Myers, A. T., (3) p. 700 report olivine bombs from Ludlow (U. S. Nat. Mus. specimen #94430) collected by W. F. Foshag. Correspondence with Foshag establishes the identity of the Siberia crater and the "Ludlow" locality. **2**, Large bombs of granular olivine occur in the basaltic rocks of the Morongo district, (N. R.).

Shasta County: **1**, Massive coarse-grained peridotite showing very good cleavage on the olivine grains, has been observed near the Little Creek chromite mine, Hawkes (3) p. 277.

OMPHACITE

See pyroxene

ONYX

See quartz, chalcedony

ONYX MARBLE

See aragonite

OPAL

Silicon dioxide, with a varying amount of water, $SiO_2 \cdot nH_2O$

Amorphous. Colloidal massive; also earthy. Prominent conchoidal fracture. Waxy or glassy luster. Color yellow, brown, green, blue, red, white, gray, and colorless. Streak white. H. = 5½-6½. G. = 2.1-2.2.

Gives a slight amount of water in a closed tube, otherwise like quartz and chalcedony in its reactions.

Common opal occurs in white, yellow, brown, bluish, or greenish masses having a prominent conchoidal fracture. *Fire opal* is opal with fire-like reflections. *Hyalite* is transparent glassy opal found in the cavities of volcanic rock. *Chrysopal* or *prase opal* is a greenish opal found with chrysoprase. *Moss opal* is common opal with moss-like inclusions of pyrolusite or chlorite. *Wood opal* is petrified wood. Geyserite is a hydrous silica formed about the vents of geysers and hot springs. *Diatomaceous earth* and *infusorial earth* are deposits of opaline silica formed by diatoms.

Opal is colloidal silica containing from 2 to 10 percent water. It occurs as veins, nodules, and coatings.

The occurrences of opal are too numerous to list in detail, except in cases where the deposit is of particular interest. Wood opal, that is to say, petrified wood, has been found in a few important localities, and in small amounts in the following counties: Alpine, Amador, Butte, Calaveras, Lassen, Nevada, Plumas, Riverside, Sierra, Sonoma, Tulare, and Tuolumne.

Diatomaceous earth has been found in Fresno, Inyo, Lake, Lassen, Los Angeles, Merced, Mono, Napa, Orange, Placer, San Luis Obispo, San Mateo, Santa Barbara, Shasta, Sonoma, and Tulare Counties.

Calaveras County: **1**, Considerable amounts of rich white opal, none of gem character, were found in a buried gravel in Chile Gulch, near Mokelumne Hill, J. R. Browne (4) p. 56, Kunz (24) p. 76, Lewis (1) p. 37.

Fresno County: **1**, Moss opal has come from the mountains east of Fresno, Woodhouse (p. c. '45).

Kern County: **1**, Canary-colored moss opal has been found 18 miles southwest of Johannesburg, Stoddard (2) p. 217. **2**, "Milk" or "resin" opal occurs near Rosamond, Lewis (1) p. 37. **3**, Some precious opal has been mined east of Red Rock Canyon, Lewis (4) p. 116. **4**, Wood opal occurs in the Petrified Forest, Last Chance Canyon, Murdoch (p. c. '45).

Lake County: **1**, Pale blue opal occurs as irregular masses in hydrothermally altered andesite at the Sulphur Bank mine, Brice (1) p. 62.

Los Angeles County: **1**, An extensive deposit of diatomaceous earth has been mined near Lomita, F. J. H. Merrill (2) p. 507.

Mono County: **1**, Fluorescent hyalite occurs as thin coatings on joint surfaces in the Morris claims, Benton district, Lemmon (6) p. 591.

Napa County: **1**, Gem quality "prase" has been found in a 10-inch vein at the Lone Pine chromite mine 3½ miles from Knoxville, S. M. B. (20676).

San Bernardino County: **1**, Semi-precious opal, amber and pink in color occurs in an eastern branch of Blacks Canyon about 25 miles northwest of Barstow (T. 32 S., R. 44 E., M. D.), Kunz (21) p. 76, Sterrett (7) p. 1050, Baker (1) p. 347.

Santa Barbara County: **1**, A very large and pure deposit of diatomaceous earth has been mined near Lompoc, Huguenin (1) p. 737, Mulryan (1) p. 133. **2**, Opalized termite pellets have been found near Santa Maria, A. F. Rogers (45) p. 389.

Siskiyou County: **1**, Fire opal has been found near Dunsmuir, Kunz (21) p. 76. **2**, Greenish stalactitic and coralloidal opal has been found in "the Catacombs," Lava Beds National Monument (secs. 28, 33, T. 45 N., R. 4 E., M. D.), Swartzlow and Keller (1) p. 101.

Sonoma County: **1**, Fire opal has been found in kaolin on the Weise Ranch, between Glen Ellen and Kenwood, W. W. Bradley (2) p. 321. **2**, Large trees of petrified wood are found in the Petrified Forest west of Calistoga, Kunz (24) p. 78. **3**, Crusts of peculiarly delicate capillary fibers of opal have been found at The Geysers, Vonsen (6) p. 291.

Tehama County: **1**, Stalactites and stalagmites of opal are found in a lava tunnel on the north side of Inskip Hill (T. 29 N., R. 1 W., M. D.), C. A. Anderson (3) p. 22, (6) p. 310.

Tulare County: **1**, Green "chrysopal" comes from the chrysoprase mine near Lindsay, Kunz (24) p. 76.

ORANGEITE

See thorite

ORPIMENT

Arsenic sulphide, As_2S_3

Monoclinic. Usually in foliated masses. One perfect cleavage. Sectile. Pearly luster. Color lemon yellow. Streak pale yellow. H. = 1½-2. G. = 3.4-3.5.

Like realgar in the reactions. Readily distinguished from realgar by color. The two are usually associated and realgar alters into orpiment.

Kern County: 1, A foliated massive specimen of orpiment has come from this county, W. W. Bradley (31) p. 97.

Lake County: 1, Orpiment with realgar is said to have been found on the Eel River, about 15 miles northwest of Bartlett Springs, (N. R.).

Siskiyou County: 1, Foliated orpiment has come from this county, W. W. Bradley (31) p. 97.

Sonoma County: 1, It occurs with curtisite and realgar at Skaggs Springs (T. 10 N., R. 11 W., M. D.), W. W. Bradley (28) p. 469, Everhart (4) p. 390.

Trinity County: 1, Yellow orpiment occurs in the decomposition of the iron sulphides at the Island Mountain copper mine, Vonsen (p. c. '45).

ORTHITE

See allanite

ORTHOCLASE

See feldspar

OTAYLITE

See montmorillonite

OTTRELITE

See chloritoid

PAIGEITE

See vonsenite

† PALACHEITE, 1903

See botryogen

* PALAITE, 1912

See hureaulite

PANDERMITE

See priceite

PARGASITE

See amphibole

PARISITE

A fluo-carbonate of calcium and the rare earths, $(Ca,La)_2Ca(CO_3)_3F_2$

Hexagonal. Most crystals elongated. H. = 4.5. G. = 4.36. Luster vitreous to resinous. Color brownish yellow. Normally a pegmatite mineral of late phase.

San Bernardino County: 1, Parisite in small amounts has been identified in the ores of the bastnaesite deposit at Mountain Pass, Olson (2), quoted in Wright et al. (5) p. 125.

* PARTZITE, 1867

Hydrous oxide of antimony, copper and other bases

Massive. Color blackish green to black. H. = 3-4. G. = 3.8. *Stetefeldite* is similar but with more silver.

According to Palache et al. (10) p. 599, partzite is a mixture of oxides, and does not warrant species rank.

Mono County: **1**, It has been reported from various mines in the Blind Springs Hill district, W. P. Blake (13) p. 119, Arents (1) p. 362, Loew (2) p. 185, A. L. Ransome (2) p. 192. Partzite from Blind Spring Hill has been shown to be possibly a hydrated copper antimonate, with the pyrochlore structure, Mason & Vitaliano, (1) p. 106. Its formula is probably $Cu_ySb_{2-x}(O,OH,H_2O)_{6-7}$.

PEACOCK ORE

See bornite

PECTOLITE

Calcium and sodium basic silicate, $Ca_4Na_2Si_6O_{16}(OH)_2$

Triclinic. In acicular crystals. Generally fibrous massive. One perfect cleavage. Luster silky to vitreous. Brittle. Color white or gray. H. = 5. G. = 2.68-2.78.

Easily fusible to a clear glass and easily soluble, sometimes yielding gelatinous silica. A small amount of water is obtained in a closed tube.

Colusa County: **1**, Pectolite occurs with calcite and zeolites in serpentine near Wilbur Springs, Vonsen (p. c. '33).

Lake County: **1**, Extensive veins of fibrous pectolite occur with calcite in serpentine 1½ miles east of Middletown in a cut on the highway to Lower Lake, Vonsen (p. c. '34).

Mono County: **1**, Pectolite was doubtfully reported by Aaron in a boulder near Montgomery, at the foot of the White Mountains, Hanks (12) p. 277.

San Benito County: **1**, Massive, compact and radiating masses of pectolite occur in veins in basalt (sec. 32, T. 18 S., R. 12 E., M. D.), along the trail to the benitoite gem mine, Murdoch (p. c. '45).

San Francisco County: **1**, Fibrous pectolite occurs as veins in an altered dike which intersects the serpentine at Fort Point. It was described and analyzed by Eakle (1) p. 316, Kunz (24) p. 96.

Santa Barbara County: **1**, A large quantity of fibrous crystalline material which phosphoresces when broken in the dark, was found on the J. C. Keyes claim, 7 miles north of Santa Ynez, Hanks (16) p. 44, Irelan (4) p. 47. **2**, It has been reported on the Santa Barbara Islands, E. S. Dana (5) p. 1097.

Sonoma County: **1**, Narrow veins of pectolite are widely distributed at The Geyers, Vonsen (p. c. '45).

Tehama County: **1**, A large vein of pectolite occured in serpentine on Elder Creek (sec. 16, T. 25 N., R. 7 W., M. D.), Kunz (3) p. 561. It was analyzed by Eitel, in Preston (2) p. 693.

PENNINITE

See chlorites

PENTAHYDRITE

Magnesium sulphate pentahydrate, $MgSO_4{\cdot}5H_2O$

White pseudomorphic dehydration product of epsomite.
Artificial is triclinic pinacoidal. G. = 1.718.

Sonoma County: **1**, Unnamed substance with analysis giving above formula described as constituent of efflorescent salts at The Geysers. Allen and Day (2). Called pentahydrite by Frondel, Palache (11).

PENTLANDITE

Nickel and iron sulphide, $(FeNi)_9S_8$

Isometric. Massive, granular. Octahedral parting. Brittle. Metallic luster. Color light bronze yellow. Streak light bronze brown. H. = 3½-4. G. = 5.0.

Fuses easily, yielding a magnetic globule. Soluble in nitric acid.

San Diego County: **1**, Hudson (1) p. 219, has reported the probable occurrence of pentlandite with pyrrhotite and chalcopyrite in the nickel ore of the Friday mine near Julian. See also Donnelly (1) p. 370. Residual cores of pentlandite altering to violarite are common in the massive pyrrhotite ore of this mine, Murdoch (p. c. '45).

Ventura County: **1**, Pentlandite has been found with millerite and pyrrhotite at the Ventura mine (T. 1 N., R. 18 W., S. B.), Tucker and Sampson (20) p. 258.

PERICLASE

Magnesium oxide, MgO

Isometric. Cubes and octahedrons. Cubic cleavage. White or colorless. H. = 5½. G. = 3.5-3.6.

Infusible, but completely soluble. Ammonia and sodium phosphate added to hydrochloric acid solution gives a white precipitate. Alters to brucite.

Riverside County: **1**, Periclase was found altering to brucite, in the old city quarry at Riverside, A. F. Rogers (19) p. 581. **2**, It was later reported by A. F. Rogers (19) p. 583, (31) p. 462, from the Wet Weather quarry at Crestmore. **3**, Periclase occurs in the contact zone at the new city quarry just south of Riverside, Richmond (1) p. 725. **4**, Good residual cores of periclase, up to 1 mm in diameter, have been found in the brucite pseudomorphs of the Jensen quarry, MacKevett (1) p. 6, Murdoch (p.c. '51).

PEROVSKITE

Calcium titanium oxide, with rare earth metals, $CaTiO_3$

Pseudoisometric, possibly monoclinic. Crystals cubic, and cubo-octahedral. Rarely reniform, massive and granular. Basal pinacoidal cleavage imperfect, fracture uneven to subconchoidal, brittle. H. = 5½. G. = 4.01. Luster adamantine to metallic and dull. Color black, grayish black, brownish black, reddish brown to shades of yellow. Streak colorless, grayish.

Infusible. Decomposed by hot concentrated H_2SO_4 and by HF.

Riverside County: **1**, Small bright amber crystals, octahedral in habit, have been found in the contact zone at Crestmore, on the 910-foot level, Murdoch (25) pp. 573-580.

San Benito County: **1**, Shiny black crystals of perovskite as much as a quarter of an inch in size, with the cubic form dominant, occur in chloritic schist with black spinel and melanite garnet near the benitoite locality, Bolander (1) p. 65; Grigsby (p.c. '49); Murdoch (25) p. 573.

PETALITE

A silicate of lithium and aluminum, $(Li,Na)AlSi_4O_{10}$

Monoclinic. Crystals rare; massive foliated or prismatic. One perfect and one good cleavage. Brittle. Luster vitreous. Color white. H. = 6-6½. G. = 2.39-2.46. Fuses quietly and gives red lithium flame. Insoluble in acids.

Petalite is a rare mineral occurring occasionally in lithia pegmatites. The only other known occurrence in the United States is at Bolton, Massachusetts.

San Diego County: 1, Petalite occurs in quartz-spodumene masses, as groups of radiating and divergent needle-like grains, in the Clark vein at Rincon, Murdoch (18) p. 198. 2, Rare petalite, in white cleavage masses up to 1 inch maximum size, has been found on Queen and Hiriart Mountains, Pala, Jahns and Wright (5) p. 42. (p. c. '45).

PETZITE

Silver and Gold telluride, Ag_3AuTe_2

Isometric (?). Massive. Metallic luster. Color steel gray to black. Streak black. H. = 2½-3. G. = 8.7-9.0.

Similar to hessite in its reactions, but yields more gold in the buttons. Hessite and petzite may grade into each other so as to be indistinguishable by the blowpipe.

Petzite is usually associated with hessite, sylvanite and calaverite. It is the commonest gold telluride found in the State.

Calaveras County: 1, Petzite was found with hessite in the Stanislaus and Melones mines on Carson Hill, W. P. Blake (18) p. 178. Specimens from the Stanislaus mine have been analyzed by Genth (5) p. 310, and Küstel (1) p. 306. 2, It occurs in the Ford mine, half a mile east of San Andreas, F. L. Ransome (9) p. 9, Storms (7) p. 108, A. Knopf (11) p. 39. 3, It occurs with altaite at the Frenchwood mine, Robinsons Ferry (sec. 25, T. 2 N., R. 13 E., M. D.), Hanks (12) p. 68. 4, At the Morgan mine with calaverite and sylvanite on the north slope of Carson Hill, Hanks (12) pp. 309, 388.

El Dorado County: 1, It was found with calaverite at the Darling mine, about 3 miles northeast of American Flat (N. R.).

Nevada County: 1, Petzite occurs in the Idaho-Maryland mine, Farmin (2) p. 173.

San Diego County: 1, It has been doubtfully reported in microscopic grains from the Julian district, Donnelly (1) p. 359.

Siskiyou County: 1, Petzite is recorded with gold at the Porphyry Dike mine, near Callahan, F. McN. Hamilton (4) p. 246, S. M. B. (19621). 2, It has been found in the northern part of the county near the state line, with calaverite and free gold, (N. R.).

Trinity County: 1, Petzite occurs in some of the gold ores of the Dorleska mine (sec. 16?, T. 38 N., R. 9 W., M. D.) Coffee Creek district, Osborne (1) p. 252, Stines (1) p. 25.

Tuolumne County: 1, Petzite is one of the tellurides that occurred in the Golden Rule mine, Stines (1) p. 25, Rawhide Ranch, and Norwegian mines near Tuttletown, Silliman (9) p. 379. It was analyzed from the Golden Rule mine by Genth (5) p. 309, and from the Norwegian mine by Hillebrand (2) p. 297. 2, Petzite was found in the Bonanza mine, Sonora, S. M. B. (10019). 3, Petzite, with sylvanite and beautifully crystallized gold, was reported in the early days from Sugarman and Nigger mine, sec. 30, T. 2 N., R. 15 E., M.D., Logan (23) p. 72.

PHARMACOLITE

A hydrous arsenate of calcium, $HCaAsO_4 \cdot 2H_2O$

Monoclinic. Crystals rare; commonly silky fibers or botryoidal, stalactitic. One perfect cleavage. Flexible in thin slivers. H. = 2-2½. G. = 2.6-2.7. Luster vitreous. Color white or grayish.

A product of surface alteration of mineral deposits carrying arsenopyrite or similar minerals.

Los Angeles County: **1**, Found with erythrite and smaltite, at the O.K. mine, San Gabriel Canyon, Irelan (4) p. 47.

PHENAKITE

Silicate of beryllium, Be_2SiO_4

Hexagonal rhombohedral. Crystals commonly rhombohedral in habit. Prismatic cleavage distinct. H. = 7.5-8. G. = 2.97-3.0. Luster vitreous. Colorless or wine yellow. A typical pegmatite mineral.

San Diego County: **1**, Flat colorless crystals, none over half an inch in size, occur in the Vanderberg Katherina mine associated with blue topaz on cleavelandite, Jahns and Wright (5), p. 31.

PHILLIPSITE

Hydrous potassium, calcium, and aluminium silicate, $(Ca,Ba,K,Na)_{12}Al_{16}(Al,Si)_4Si_{20}O_{80}\cdot 30\text{-}40H_2O$

Monoclinic. Usually in groups of twinned crystals. Cleavage rather distinct. Brittle. Vitreous luster. Color white to red. Streak uncolored. Translucent to opaque. H. = 4-4½. G. = 2.2.

Fuses easily to a white enamel. Gelatinizes with hydrochloric acid.

Kern County: **1**, Occasional cavities in basalt at Red Rock Canyon have been found to contain pale salmon-pink phillipsite in poor crystals, J. Murdoch (p.c. '47).

Plumas County: **1**, Phillipsite is probably one of the zeolites occurring in very minor amount at the Engels mine, Graton and McLaughlin (1) p. 18.

Riverside County: **1**, Phillipsite occurs as secondary radial aggregates in garnet rock, at the Crestmore limestone quarry, Woodford, et al. (10) p. 362.

PHLOGOPITE

Potassium, magnesium, aluminum acid silicate, $H_2KMg_3Al(SiO_4)_3$

Monoclinic. Prismatic. Usually six-sided plates and scales. Cleavage perfect basal. Tough and elastic. Pearly luster. Color yellowish brown to brownish red; sometimes greenish or colorless. H. = 2½-3. G. = 2.78-2.85.

Reactions the same as for biotite.

Phlogopite is a mica similar to biotite, but containing little or no iron.

Fresno County: **1**, Phlogopite is found as isolated crystals or aggregates in contact limestones of the Twin Lakes district, Chesterman (1) p. 271.

Inyo County: **1**, Phlogopite occurs with scheelite in calc-hornfels at Round Valley and Deep Canyon, west of Bishop, A. Knopf (6) p. 247, Hess and Larsen (17) p. 273, Lemmon (5) p. 504.

Madera County: **1**, Phlogopite occurs in minor amounts with the magnetite deposit at Iron Mountain, Erwin (1) p. 65.

Riverside County: **1**, A few flakes of phlogopite have been observed in the white limestone of Chino Hill, at Crestmore, Eakle (15) p. 334, and in crystals up to 5 millimeters in size in calcite of the Lone Star quarry, Crestmore, Woodford, et al. (10) p. 366. **2**, Abundant crystals of phlogopite, up to one inch in diameter have been found in the contact zone at the Jensen quarry, J. Murdoch (p.c. '47).

PHOSGENITE

Chlorocarbonate of lead, $(PbCl)_2CO_3$

Tetragonal. Prismatic crystals. Cleavage prismatic and basal distinct. Adamantine luster. Color white to yellow. Streak white. H. = 2½-3. G. = 6.0-6.3.

Easily fusible to yellow bead. Reduced with sodium carbonate to metallic lead. Fused with copper oxide, it gives blue flame of copper chloride. Effervesces with dilute nitric acid.

Inyo County: **1**, Phosgenite as acicular, straw-yellow crystals in quartz came from the Silver Sprout mine, Hanks (12) p. 309.

PHOSPHOSIDERITE

See metastrengite

PICKERINGITE—Magnesia Alum

Hydrous aluminum and magnesium sulphate, $MgSO_4 \cdot Al_2(SO_4)_3 \cdot 22H_2O$

Monoclinic. Fine acicular crystals and as efflorescences. Silky luster. Colorless, white, yellowish, pink. H. =1. G. = 1.85.

Easily fusible. Soluble in water, giving a bitter, astringent taste. Yields water in a closed tube.

Inyo County: **1**, Pickeringite was reported as an efflorescence in the mountains west of Bishop (N. R.).

San Bernardino County: **1**, Pickeringite occurs as a coating on quartzite along the South Fork of Barrett Canyon, a tributary of San Antonio Canyon, sec. 31, T. 2 N., R. 7 W., S. B., R. Merriam (p. c., '36).

Shasta County: **1**, Pickeringite (?) has been found as incrustations around the hot springs of the Mount Lassen area, A. L. Day and Allen (1) p. 118.

Sonoma County: **1**, The name "sonomaite", no longer recognized as a species title, was given by Goldsmith (6) p. 263 to a mineral from near The Geysers having a composition similar to pickeringite. A. L. Day and Allen (2) p. 45, have reported pickeringite from this locality.

PICOTITE

See spinel

PICROLITE

See serpentine

PIEDMONTITE

Basic calcium, aluminum, manganese, and iron silicate, $Ca_2(Al,Fe,Mn)_3(SiO_4)_3(OH)$

Monoclinic. Prismatic crystals. One good cleavage. Vitreous luster. Color reddish brown and reddish black. Streak reddish. H. = 6½. G. = 3.4.

Fuses easily with intumescence to a black glass. Gives a violet bead of manganese with borax. Insoluble in acid.

Kern County: **1**, Piedmontite, with benitoite and other heavy minerals, has been identified in sediments penetrated by drill holes in the Lazard area, west of Lost Hill, Reed and Bailey (4) p. 363.

Lassen County: See Sierra County

Los Angeles County: **1**, Piedmontite has been found in quartz-sericite schist near the junction of Bouquet and Texas Canyons, Simonson (1) p. 737. **2**, In a ravine entering the Prairie Fork of San Gabriel River

from the south, about 3 miles above the mouth of the fork (approx. sec. 22, T. 3 N., R. 8 W., S. B.) Woodford (p. c., '36). **3**, It occurs in quartz schist with crossite and lawsonite, on Santa Catalina Island, E. H. Bailey (1) p. 1955.

Madera County: **1**, Piedmontite occurs in minute needles in a sericite schist 100 yards below the outlet of Shadow Lake, Mayo (2) p. 240, (3) p. 239. **2**, As small tablets in a metamorphosed extrusive rock at the summit of the east end of Volcanic Ridge, Mayo (2) p. 244, (3) p. 239. A. M. Short (1) p. 495, has published an analysis by T. Kameda of the piedmontite from Shadow Lake. **3**, Needles and crystals up to half an inch in size are found in metarhyolite at Garnet Lake in the Minarets district, Chesterman (p. c. '51).

Monterey County: **1**, Piedmontite grains have been found in the sediments of Monterey Bay, W. W. Bradley (18) p. 243.

Orange County: **1**, Woodford (2) p. 192 has reported the occurrence of piedmontite in a boulder of San Onofre breccia near San Juan Capistrano Point.

Plumas County: **1**, Rather abundant piedmontite is associated with braunite in the Braito (Iron Dike) mine (sec. 37, T. 26 N., R. 9 E., M. D.), Taliaferro and Hudson (3) p. 62.

Riverside County: **1**, Boulders and pebbles of quartz-piedmontite schist occur in sedimentary rocks on the south side of the Painted Hills about 3 miles north of Whitewater, W. W. Bradley (31) p. 276.

San Bernardino County: **1**, Quartz-piedmontite schist is found in a ravine entering Lytle Creek from the northeast just above the mouth of Coldwater Canyon, Mayo (3) p. 243, Woodford (p. c., '36). **2**, Piedmontite-schist pebbles occur in the alluvial fans just north of the Cajon Pass summit, Webb (6) p. 124. **3**, Crystals to 5 mm long occur in groups in vugs in metavolcanic rocks 12 miles east of Victorville, Bowen (1) p. 51, 52.

San Diego County: **1**, Piedmontite has been found in a boulder of quartz porphyry from the gravels at Pacific Beach by A. F. Rogers (7) p. 378.

Sierra County: **1**, Piedmontite in slender crystals up to one inch in length has been found in quartz veins in quartz-latite country rock that also contains some piedmontite, along the state border, between Lassen and Sierra Counties, V. P. Gianella (p. c., '45), Richard C. Frey (p. c., '53).

PILINITE

Hydrous calcium aluminum silicate, approximately $CaO \cdot Al_2O_3 \cdot 5SiO_2 \cdot H_2O$

Minute prismatic crystals, resembling asbestos. G. = 2.26. Luster of needles silky. Colorless to white. Fuses easily with strong intumescence. Insoluble in acids.

Santa Clara County: **1**, Pilinite (?) is reported from near New Almaden, S. M. B. (11956), (18243).

Yuba County: **1**, It is represented from Smartsville by S. M. B. (11525).

* PIRSSONITE, 1896

Hydrous double carbonate of calcium and sodium, $Na_2Ca(CO_3)_2 \cdot 2H_2O$

Orthorhombic-pyramidal. In prismatic crystals. Vitreous. Colorless to white. H. = 3. G. = 2.35.

Similar to gay-lussite in its reactions. Boiled in water the sodium carbonate is leached out and causes the solution to become strongly alkaline.

Pirssonite was discovered in California in 1896 and is known from only two localities.

Lake County: **1**, It occurs with gay-lussite and northupite in trona at Borax Lake, Vonsen and Hanna (4) p. 104.

San Bernardino County: **1**, Good crystals of pirssonite were found with northupite, gay-lussite, and hanksite at the New Well, Searles Lake. Pirssonite was described and named by Pratt (1) p. 126. Other references: H. S. Gale (13) p. 305, Foshag (21) p. 51.

Analysis

CO_2	CaO	Na_2O	K_2O	H_2O	Al_2O_3	SiO_2
36.07	23.38	25.70	0.15	14.73	0.13	0.29 = 100.45%

PISANITE

Hydrous iron and copper sulphate, $(Fe,Cu)SO_4 \cdot 7H_2O$

Monoclinic. Long slender prisms; stalactitic. One easy cleavage. Vitreous luster. Color greenish blue. H. = 2-3. G. = 2.15.

Reactions are similar to those for melanterite, except that ammonia turns the solution blue at the same time that it precipitates the iron as ferric hydroxide.

Alameda County: **1**, Pisanite was one of the secondary sulphates formed with melanterite and chalcanthite on the walls of the Alma pyrite mine at Leona Heights. Described and analyzed by Schaller (1) p. 199.

Monterey County: **1**, Pale-blue crystals of pisanite from near Gonzales were analyzed by Schaller (8) p. 123.

Trinity County: **1**, It was found with goslarite in the pyrrhotite mass at Island Mountain, Vonsen (p.c., '17).

PITCHBLENDE

See uraninite

PITTICITE

Hydrated arsenate and sulphate of ferric iron, perhaps $3Fe(AsO_4)Fe_4[SO_4(OH)_{10}] \cdot 6H_2O$

Amorphous. Massive and reniform. Conchoidal fracture. Vitreous luster. Color yellowish and reddish brown. H. = 2-3. G. = 2.2-2.5.

Easily fusible. Becomes magnetic on heating. Barium chloride added to the hydrochloric-acid solution precipitates barium sulphate. Gives water and the arsenic mirror in a closed tube. Soluble in hydrochloric acid.

Mariposa County: **1**, Dark-brown amorphous pitticite resembling limonite was found with scorodite as an alteration product of arsenopyrite on the South Fork of Merced River, near the mouth of Devils Gulch, A. F. Rogers (7) p. 375.

Tuolumne County: 1, Brown colloidal material from the Carlin mine near Jamestown has been referred to this species, Goudey (3) p. 12.

PLATINIRIDIUM

Native alloy of platinum and iridium, (Pt,Ir)

Isometric. Generally in grains and nuggets. Metallic luster. Color silver white. H. = 6-7. G. = 22.65-22.84.

Much of the so-called 'platinum' of the state is really this alloy; several nuggets of a few ounces weight have been found along the Trinity River.

Trinity County: 1, Nuggets from the Enright claim, 3 miles above Trinity Center, are in the State Division of Mines Exhibit, S. M. B. (1892).

PLATINUM

Native platinum, Pt

Isometric. Generally occurs in grains and small nuggets. Malleable and ductile. Metallic luster. Color and streak whitish steel gray. H. = 4-4½. G. = 14-19.

Platinum and the platinum group of minerals are soluble only in aqua regia. To detect small amounts of these minerals in sands, first concentrate by panning until a sufficient number of the gray metallic grains are obtained. Dissolve in aqua regia and to the clear solution add a few drops of potassium chloride, which will precipitate orange-yellow potassium platinic chloride.

Pure platinum is a silvery white metal with a specific gravity of 21.5. It is the heaviest metal occurring in nature, with the exception of iridosmium. It is almost as hard as iron, and very malleable. Platinum does not amalgamate with quicksilver; is not dissolved by potassium cyanide when cold; is not attacked by acids except aqua regia; and is more difficult to melt than gold. Platinum is most readily distinguished as follows: (1) By its great weight—in panning it remains even behind gold in the pan; (2) by its white color—it is whiter than lead and is distinguished from amalgam by its smooth surface, whereas the surface of amalgam, as seen under a good glass, is rough; (3) by its resistance to nitric acid as compared with native silver or lead.

Native platinum has been found most frequently in gold-bearing sands, and in this state has not been found otherwise. On account of its weight it remains in the sluices with gold and other heavy material. The native platinum is usually very impure. Occasionally it contains so much iron and other impurities as to be dark in color and not easily distinguished from grains of chromite with which it is very frequently associated. It is often accompanied by iridosmine, which occurs as flat angular scales, while platinum grains are usually rounded like gold dust. Analyses of California platinum show the presence of all other members of the platinum group, Genth (2) p. 209, Deville and Debray (1) p. 496, Weil (1) p. 354.

Deville and	Pt	Ir	Iridos.	Pd	Rh	Fe	Cu	Au	SiO_2
Debray	85.80	1.05	1.10	0.60	1.00	6.75	1.40	0.80	2.95
Genth	90.24	2.42	0.68	some	some	6.66	--	--	--
Weil	57.75	3.10	27.65	0.25	2.4	6.79	0.20	--	--

Many of the black sands have been investigated by D. T. Day and R. H. Richards (6) p. 152.

Gray metallic grains and small nuggets of platinum were early observed in some of the gold-bearing black sands of the streams and beaches, and in the concentrates from the gold washings. Mason (1) p. 536, in a letter from Monterey dated August 7, 1848, records the presence of a small piece of ''platina'' mixed with gold. Teschemacher (2) p. 121, notes 50 granules of platinum in an ounce of gold dust. R. M. Patterson (1) p. 61, comments on the presence of platinum in California gold sands. J. B. Trask (1) p. 23 gives a number of occurrences of platinum from gold sands.

Generally, platinum grains are smaller than gold grains, and large nuggets are unknown. Some of the largest nuggets have come from the

Junction City district, along the Trinity and lower courses of its tributaries from Weaverville to North Fork, Logan (1) p. 82.

References to platinum occurrences not specifically mentioned in the county descriptions below, are: D. T. Day (5) p. 410; Hanks (12) p. 310; Kunz (24) p. 42; Silliman (12) p. 132; F. McN. Hamilton (4) p. 759; Angel (2) p. 598; Laizure (1) p. 497; Logan (1) p. 50.

The occurrence of platinum in the gold sands of the state is widespread, and has been described in detail by Logan (1), Bulletin 85 of the California State Mining Bureau. The principal production of platinum has come from Butte, Del Norte, Humboldt, Placer, Siskiyou, Stanislaus, and Trinity Counties. It has also been found in the gold sands of the following counties: Calaveras, El Dorado, Inyo (?), Kern, Mendocino, Merced, Nevada, Plumas, Santa Barbara, Santa Cruz, Shasta, Tehama, Ventura, Yuba.

Mariposa County: **1**, A reported occurrence of platinum at Devils Gulch, Castello (5) p. 142, is highly doubtful, and possibly should be excluded.

Mendocino County: **1**, Platinum has been found associated with cinnabar, zircon, and gold in some of the sands of the Navarro River, Anderson Valley, Hanks (12) p. 310.

Plumas County: **1**, Platinum, almost always with grains of cinnabar, has been found in the North Fork, Feather River at and below Rich Bar, Edman (2) p. 401. **2**, Several pieces up to the size of a large bean, have been found on Nelson Creek, Hanks (12) p. 310.

Trinity County: **1**, Nuggets up to $2\frac{1}{2}$ ounces Troy weight have been found on Hay Fork, Trinity River, Hanks (1) p. 162, (12) p. 310. **2**, Nuggets up to 1 ounce have come from Junction City, Bixby (1) p. 154. **3**, A nugget weighing about $\frac{2}{3}$ of an ounce (310 grains) was found at the Old Eagle mine (sec. 9, T. 33 N., R. 11 W., M. D.) S. M. B. (11959). **4**, Another just over 1 ounce (484.4 grains), came from sec. 9, T. 33 N., R. 10 W., M. D., S. M. B. (11958).

* PLAZOLITE, 1920

Hydrous calcium and aluminum silicate, $3CaO \cdot Al_2O_3 \cdot 2(SiO_2CO_2) \cdot 2H_2O$

Isometric. In minute dodecahedrons. Brittle. Vitreous luster. Colorless to light yellow. H. = $6\frac{1}{2}$. G. = 3.129.

Fusible, and easily soluble in hydrochloric acid, with separation of silica without gelatinization. Gives water in a closed tube.

Riverside County: **1**, Plazolite occurred as minute crystals with idocrase in the limestone quarry at Crestmore. Only a few specimens were found. It was named, analyzed, and described by Foshag (3) p. 183.

	I	II	III
SiO_2	24.13	23.85	25.06
Al_2O_3	23.66	22.77	24.63
CaO	40.22	40.13	40.13
MgO	0.12	--	tr.
H_2O	--	9.39	9.04
CO_2	--	3.41	1.13
	100.34%	99.55%	99.99%

Massive white plazolite with black gehlenite occurred in Commercial quarry, Crestmore, Woodford (10). Plazolite has been found at Crest-

more in tetrahedral crystals up to $\frac{3}{4}$ inch across. The forms present are 211, possibly also $2\bar{1}1$ and 221, Schwartz and Murdoch (p.c. '54).

PLEONASTE

See spinel

PLUMBAGO

See graphite

PLUMBOGUMMITE

Hydrous lead and aluminum phosphate, $2PbO \cdot 3Al_2O_3 \cdot 2P_2O_5 \cdot 7H_2O$

Hexagonal. Gumlike, incrustations, compact massive. Resinous luster. Color yellowish, brownish. Streak uncolored. H. = 4-5. G. = 4-4.9.

Fused on charcoal with sodium carbonate, a yellow coating and metallic globule of lead are obtained. The nitric-acid solution gives the phosphate reaction on adding to ammonium molybdate. Yields water in a closed tube.

Inyo County: **1**, Plumbogummite has been reported from the Cerro Gordo mine (N. R.).

PLUMBOJAROSITE

A sulphate of iron and lead, $PbFe_6(OH)_{12}(SO_4)_4$

Rhombohedral. In minute tabular crystals. Cleavage rhombohedral. G. = 3.67. Color dark brown.

Inyo County: **1**, Found as a secondary alteration product in the Darwin district, Kelly (4) p. 545.

POLLUCITE

Hydrous caesium aluminum silicate, $2Cs_2O \cdot 2Al_2O_3 \cdot 9SiO_2 \cdot H_2O$

Isometric. In cubic crystals; also massive. Colorless. H. = $6\frac{1}{2}$. G. = 2.901.

Difficultly fusible. Decomposed by acid.

San Diego County: **1**, Massive pollucite occurs in small amounts in the gem-bearing pegmatites near Pala and Mesa Grande, W. T. Schaller (p. c., '35) (S. M. B. 20623).

POLYBASITE

Silver antimony sulphide, Ag_9SbS_6

Monoclinic. Tabular crystals and massive. Metallic luster. Color iron black. Streak black. H. = 2-3. G. = 6.0-6.2.

In its blowpipe reactions polybasite is like stephanite and pyrargyrite.

Polybasite closely resembles stephanite; the two are often mixed and are seldom differentiated. When in good crystals they can be distinguished, but when massive, their separate identification is difficult.

Alpine County: **1**, Specimens of polybasite have come from the Pennsylvania mine in the Silver Mountain district (N. R.). **2**, Hanks (12) p. 311, and Eakle (16) p. 13 observed it in microscopic crystals from the Morning Star and Monitor mines in the Mogul district.

San Bernardino County: **1**, It has been found with pyrargyrite and stephanite in the Carlyle mine, Dale district (sec. 11, T. 1 S., R. 12 E., S. B.), Tucker and Sampson (27) p. 61.

POLYDYMITE

See violarite

* POSEPNYTE, 1877

An oxygenated hydrocarbon

In hard brittle plates or nodules. Color light green and brown.

Lake County: **1**, Posepnyte was found at the Great Western mine and was described and named by von Schröckinger (1) p. 129, with analyses by Dietrich. Part was soluble in ether, and part insoluble, the latter corresponding to ozocerite. Becker (4) p. 360 gives an analysis by Melville of similar material. Additional reference: Wagoner (2) p. 334.

	Sol.			Insol.			
	C	H	O	C	H	O	Ash
von Schröckinger	71.84	9.95	18.21	84.27	11.74	3.99	--
Melville	--	--	--	85.60	10.71	3.22	0.47

Napa County: **1**, Posepynite was found with aragotite at the Redington (?) mine, Rolland (1) p. 101.

POTASH ALUM—Kalinite

Hydrous aluminum and potassium sulphate, $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

Isometric. Mealy crusts and fine fibres. Vitreous luster. Colorless or white. H. = 2. G. = 1.76.

Gives the violet flame of potassium when fused on platinum wire. Ammonia precipitates flocculent aluminum hydroxide, and barium chloride precipitates barium sulphate from solution. Yields much water in a closed tube. Easily soluble in water.

Alpine County: **1**, Potash alum was found in the mines of Silver Mountain, A. Williams, Jr. (1) p. 606, as an efflorescence on argillaceous rocks.

Calaveras County: **1**, It was observed at Quail Hill, Silliman (7) p. 351.

Contra Costa County: **1**, Fine specimens of crystallized potash alum have come from the old coal mine at Nortonville (N. R.).

Fresno County: **1**, It was common with sulphur in the oil district at Coalinga (N. R.).

Inyo County: **1**, Potash alum was found on the shores of Owens Lake (N. R.). **2**, It occurred at white crusts on the sides of a steaming vent 2 miles east of Coso Hot Springs, A. F. Rogers (7) p. 376.

Lake County: **1**, It occurs as thick incrustations with other sulphates at the Sulphur Bank cinnabar mine, A. Williams, Jr. (2) p. 949.

Los Angeles County: **1**, It was reported near Newhall by Hanks (12) p. 68.

Mono County: **1**, Occurred sparingly as coatings on rock about 5 miles east of north from Bodie, Whiting (1) p. 356. **2**, It occurs with alunite and sulphur in the andalusite deposits of the White Mountains, Woodhouse (4) p. 37.

Napa County: **1**, On Howell Mountain, 5 miles north of St. Helena, an alum "lode" has been reported, A. Williams, Jr. (1) p. 606.

Placer County: **1**, It occurred in the gold mines near Dutch Flat (N. R.). **2**, In slates near Auburn, Hanks (12) p. 68. **3**, Accompanied by coquimbite at Whiskey Hill, near Lincoln, Silliman (7) p. 351.

San Bernardino County: **1**, A specimen associated with pickeringite or halotrichite, in the National Museum, is labelled as coming from this county. Larsen (11) p. 94.

San Diego County: **1**, A specimen S. M. B. (12066) is from the Ready Relief mine, in the Banner district; reported as abundant in the mine openings in the district, Donnelly (1) p. 362.

Santa Barbara County: **1**, It was reported in 1792 as a coating with sulphur at the Fire Volcano between Santa Barbara Channel and La Purisima, Martinez (1) p. 39.

Sonoma County: **1**, It was abundant at The Geysers, Hanks (12) p. 68. **2**, Massive, stony alum occurs on Hoods Mountain, 4 miles from Guilicos Ranch, between Sonoma and Santa Rosa, Mining and Scientific Press (11) p. 264.

POWELLITE

Calcium molybdate with calcium tungstate, $CaO \cdot (Mo,W)O_3$

Tetragonal. Minute pyramids. Poor pyramidal cleavage. Brittle. Resinous luster. Color greenish yellow. H. = $3\frac{1}{2}$. G. = 4.35-4.53.

Fusible with difficulty to a gray mass. Soluble in nitric and hydrochloric acids. A deep-blue solution is obtained by boiling the powdered mineral in a few drops of strong sulphuric acid and adding a pinhead scrap of paper.

Inyo County: **1**, Powellite occurs in the Pine Creek tungsten mine at the head of Pine Creek in the Sierra Nevada west of Bishop, Young (6) p. 605, Bateman (1) p. 236. **2**, Powellite is found with scheelite at the Powell tungsten property (sec. 24, T. 19 S., R. 40 E., M. D.). **3**, At the Panyo tungsten mine with molybdenite (T. 20 S., R. 40 E., M. D.), Tucker and Sampson (30) p. 570.

Kern County: **1**, Powellite occurs in veins in El Paso Mountains, about 12 miles northwest of Randsburg, Hess (14) p. 48. **2**, Powellite is found in minor amount in the tin ores at Gorman, Wiese and Page (1) p. 39.

Mono County: **1**, Powellite is found with molybdenite on the Morris claims, Benton Range (sec. 23, T. 35 S., R. 31 E., M. D.), Lemmon (6) p. 591.

Tulare County: **1**, It has been found near Lemon Cove, pseudomorphous after molybdenite, Stanford University Collections. This may be the same as Hill Bros. prospects (sec. 14, T. 15 S., R. 28 E., M. D.), W. O. Jenkins (1) p. 175.

PRASE

See quartz, chalcedony; opal

PRASE OPAL

See opal

PREHNITE

Calcium and aluminum silicate, $H_2Ca_2Al_2Si_3O_{12}$

Orthorhombic. Tabular crystals, granular, drusy masses. One cleavage distinct. Vitreous luster. Color light green to white, brown. Streak uncolored. H. = $6\text{-}6\frac{1}{2}$. G. = 2.8-2.95.

Fuses with intumescence to an enamel. Gives water in a closed tube. The fused mass will gelatinize with hydrochloric acid. Slightly soluble.

Prehnite is sometimes present as green drusy coatings and veins in altered diabase and lavas, but it is not common in the state.

Colusa County: **1**, Prehnite has been found in veins with calcite and pectolite in serpentine near Wilbur Springs, Vonsen (p. c., '33).

El Dorado County: **1**, It is found in veinlets with diopside at Traverse Creek, 2½ miles west of Georgetown, Pabst (2) p. 3.

Inyo County: **1**, It occurs in veinlets with epidote at the Pine Creek tungsten mines, Hess and Larsen (17) p. 276.

Los Angeles County: **1**, Found in botryoidal crusts on fracture surface on basalt at the Pacific Electric quarry, Brush Canyon (sec. 35, T. 1 N., R. 14 W., S. B.), Neuerburg (1) p. 158, locality 2. **2**, Veins of calcite and prehnite occur in basalt at locality 3, south end of Cahuenga Pass, ibid. p. 158.

Marin County: **1**, It occurs in crystals, with crystallized axinite, in the hills around Stinson Beach, Vonsen (p. c., '45).

Plumas County: **1**, It occurs as a hydrothermal product at the Engels mine, Graton and McLaughlin (4) p. 18.

Riverside County: **1**, Green drusy and light-brown prehnite occur in cavities of white feldspar in the pegmatite veins of the limestone at Crestmore, Eakle (15) p. 351. Foshag (12) p. 88, also reports orange crystals here associated with wollastonite and datolite, in pegmatite.

San Diego County: **1**, Prehnite from Smiths Mountain, near Oak Grove, has been analyzed by Schaller, Clarke (9) p. 273.

San Luis Obispo County: **1**, Prehnite occurs in the analcite diabase of Cuyamas Valley, Fairbanks (12) p. 289.

PRICEITE—Pandermite

Hydrous calcium borate, $Ca_5B_{12}O_{23} \cdot 9H_2O$

Triclinic. Massive, chalky. One perfect cleavage. Color snow white. H. = 3-3½. G. = 2.43.

Easily fusible and gives green flame. Soluble in dilute hydrochloric acid. Gives water in a closed tube.

Inyo County: **1**, Priceite was found as nodules and irregular masses in soft gray shale in the second wash to the west of the Russell mine, Mount Blanco district, Foshag (10) p. 10, (11) p. 11. **2**, It was later found in extensive massive veins or narrow lenses in shale, filling cracks in altered basalt near the mouth of Corkscrew Canyon, and as amygdule fillings, sometimes large, Foshag (25) p. 728. In the veins it is partly altered to delicate radiating needles of ulexite, or crystals of colemanite. **3**, It is doubtfully reported as incrustations at Bennetts Well and Furnace Creek, G. E. Bailey (2) pp. 45, 466.

San Bernardino County: **1**, Priceite is reported from Owl Springs with colemanite in the niter beds (T. 18 N., R. 3 E., S. B.), G. E. Bailey (2) p. 62, Cloudman et al. (1) p. 855. **2**, Hanks (12) p. 313 reports priceite from Calico.

* PROBERTITE—Kramerite, 1929

Hydrous sodium and calcium borate, $NaCaB_5O_9 \cdot 5H_2O$

Monoclinic. In radial glassy aggregates. Perfect prismatic cleavage. Brittle. Vitreous luster. Colorless. H. = 2½-3½. G. = 2.14.

Easily fusible. Decrepitates and yields water in a closed tube. Soluble in acids; slightly soluble in water.

Inyo County: **1**, Probertite, locally known as "boydite", occurs with colemanite and ulexite as translucent satiny needles in the Widow and Upper Biddy McCarthy mines near Ryan, Foshag (18) p. 338.

Kern County: **1,** Probertite was described by Eakle (26) p. 427 as a new mineral from the Kramer district where it occurs in clay with borax and kernite. Schaller (45) p. 139 described the crystals and occurrence under the name of "kramerite." Analysis by Schaller gave:

Na_2O	CaO	B_2O_3**	H_2O	
8.12	15.42	50.73	25.73 = 100.00%	G. = 2.141

**By difference.

2, Additional references for Kramer district, Murdoch (17) p. 720, H. S. Gale (16) p. 362, both for the Suckow mine. The earlier reference was to an occurrence in the West Coast Borax Company's mine.

Los Angeles County: **1,** It is abundant at the Sterling borax mine, Tick Canyon, as compacted rosettes of rather coarse needles, in the borax ore, Murdoch (17) p. 719.

PROCHLORITE

See chlorites

PROUSTITE—Ruby Silver Ore

Silver arsenic sulfide, Ag_3AsS_3

Hexagonal-rhombohedral. Prismatic crystals and massive. Cleavage rhombohedral distinct. Brittle. Adamantine luster. Color and streak scarlet red. H. = 2-2½. G. = 5.57-5.64.

The reactions of proustite are similar to those of pyrargyrite. The two minerals often are intermixed or grade into each other.

The term "ruby silver" is given indiscriminately to proustite and pyrargyrite. Both minerals usually contain arsenic and antimony. The metallic gray pyrargyrite is more common than the transparent red proustite, but the two are often associated.

Alpine County: **1,** Proustite has been reported from the Exchequer mine, Silver Mountain, R. W. Raymond (10) p. 23.

Kern County: **1,** Specimens of proustite with pyrargyrite have come from the old Amalie district, Dyke (1) p. 764. **2,** Proustite is the principal silver mineral in the Cactus Queen and Blue Eagle, sec. 17, T. 10 N., R. 13 W., S.B., Tucker, Sampson and Oakeshott (37) p. 216.

Mariposa County: **1,** It occurred with pyrargyrite and argentite in the Bryant silver mine, Laizure (6) p. 123, (8) p. 44.

Mono County: **1,** It was found in the Oro and Bodie mines, Bodie district, Hanks (12) p. 314.

Napa County: **1,** Proustite has been found in the Palisades mine, about 2 miles north of Calistoga, Crawford (2) p. 414.

San Bernardino County: Proustite is a minor constituent of the silver ores of the Rand district, Hulin (1) p. 98.

Shasta County: **1,** It occurred with galena, pyrite, and quartz in the Chicago mine, near Igo, Hanks (12) p. 314.

PSEUDOMALACHITE

Basic copper phosphate, $Cu_{10}(PO_4)_4(OH)_8 \cdot 2H_2O$

Monoclinic, usually prismatic crystal aggregates forming drusy or botryoidal surfaces. One cleavage distinct. H. = 4½-5. G. = 4.35±. Luster vitreous. Color dark emerald green (crystals), lighter green (massive); streak paler green. Translucent to subtranslucent. A secondary mineral associated with malachite in the oxidized zone of copper deposits.

Inyo County: **1**, Pseudomalachite is reported associated with the lead-silver ores in the oxidized zone of the Darwin lead mine, C. D. Woodhouse (p.c. '51).

PSILOMELANE

A manganese oxide, usually impure, $BaR_9O_{18} \cdot 2H_2O$(?) R = Mn'''', chiefly, also Mn'', Co

Massive, botryoidal, stalactitic. Prominent conchoidal fracture. Luster submetallic, dull. Color black. Streak brownish black. H. = 5-7. G. = 3.3-4.7.

Yields the manganese reactions as given under hausmannite, as well as water in a closed tube, and tests for barium.

The massive fine-grained oxides of manganese form a group whose members it is impossible to separate by ordinary means of identification. They may be distinguished usually by x-ray determination. It is recommended, Fleischer and Richmond (1) p. 271, that massive, hard, heavy material not specifically identified should be referred to as belonging to the "*psilomelane type,*" and massive, soft material of apparent low specific gravity should be referred to as "wad." *Asbolite* is a wad containing cobalt. In the following notation of occurrences, the word "psilomelane" must be considered as meaning "psilomelane type," unless specific determination is indicated.

Most of the manganese deposits are composed of the oxides at and near the surface, changing to the primary minerals with depth.

Detailed reports on the manganese deposits of California have been issued by the State Division of Mines as Bulletins 76 and 125.

Alameda County: **1**, Psilomelane is the chief mineral in the manganese deposits near Corral Hollow and the Arroyo Mocho, Watts (2) p. 121, Huguenin and Costello (4) pp. 26-28, Laizure (9) p. 53.

Amador County: **1**, Deposits of psilomelane mixed with pyrolusite occur 1½ miles south of Volcano, W. W. Bradley et al. (4) p. 29, Laizure (9) p. 71. **2**, 4 miles east of Pine Grove (N.R.), W. W. Bradley et al. (4) p. 31. **3**, About half a mile southeast of Defender, ibid. p. 29.

Butte County: **1**, Psilomelane occurs in several localities near Clipper Mills (sec. 35, T. 20 N., R. 7 E., M. D.), C. A. Waring (4) p. 224, W. W. Bradley et al. (4) p. 30.

Calaveras County: **1**, Deposits of psilomelane occur 2 miles northeast of San Andreas, W. W. Bradley et al. (4) p. 31. **2**, Asbolite is reported 6 miles southeast of Valley Springs, W. W. Bradley (23) p. 500. **3**, Psilomelane with pyrolusite occurs 3 miles northeast of Milton (N. R.). **4**, Asbolite came from 1 mile east of Mokelumne Hill, F. McN. Hamilton (4) p. 760, Logan (8) p. 142.

Colusa County: **1**, Psilomelane occurs in small amounts on the eastern slope of St. Johns Mountain, east of Stonyford, Harder (1) p. 164, W. W. Bradley (1) p. 180.

Contra Costa County: **1**, Psilomelane was formerly mined on Red Rock in San Francisco Bay, Lawson (2) p. 423, (7) p. 23, W. W. Bradley et al. (4) p. 31, Huguenin and Castello (4) p. 55.

Fresno County: **1**, Psilomelane occurs on Pine Flat, near Piedra, W. W. Bradley et al. (4) p. 32.

Glenn County: **1**, It occurred with pyrolusite at the Black Diamond and Rattlesnake mines (sec. 14, T. 18 N., R. 7 W., M. D.), about 30 miles southwest of Fruto, W. W. Bradley et al. (4) p. 32.

Humboldt County: **1**, It occurs with pyrolusite as massive ore on the Porter Ranch (sec. 32, T. 3 N., R. 4 E., H.), W. W. Bradley et al. (4) p. 33. **2**, On Charles Mountain (sec. 2, T. 1 S., R. 4 E., H.), Averill (10) p. 519.

Imperial County: **1**, Psilomelane deposits have been reported in the Chocolate Mountains, W. W. Bradley et al. (4) p. 34, 35. **2**, As filling of basalt breccia (T. 9, 10 S., R. 19, 20 E., S. B.), E. L. Jones, Jr. (1) p. 201. **3**, There are many other minor occurrences in the county, R. J. Sampson and Tucker (18) pp. 128-130. **4**, Psilomelane is found in the Paymaster district (sec. 16, 18, 19, T. 11 S., R. 21 E., S.B.) Hadley (1) p. 465.

Inyo County: **1**, It is found at the southeast end of the Panamint Range, 25 miles south of Bennetts Wells on the Death Valley slope, W. W. Bradley et al. (4) p. 36.

Kern County: **1**, Wad has been found as a pseudomorph after calcite at the Echo mine near Mojave, A. F. Rogers (3) p. 18.

Lake County: **1**, Small amounts of good manganese ore come from Glenbrook (N. R.). **2**, Psilomelane occurs on the Phillips Ranch, about 1½ miles south of Laurel Dell, Huguenin and Castello (4) p. 78. **3**, On Dry Creek about 3 miles west of Middletown, W. W. Bradley et al. (4) p. 37. **4**, A large deposit of it occurs about 10 miles north of Upper Lake on the southwestern slope of the Horse Mountains, in sec. 10, T. 16 N., R. 10 W., M. D., ibid. p. 37.

Los Angeles County: **1**, Asbolite occurred in the O. K. mine, San Gabriel Canyon, S. M. B. (11599). **2**, Deposits of siliceous psilomelane occur about 5 miles west of Palmdale, W. W. Bradley et al. (4) p. 38, F. J. H. Merrill (2) p. 479.

Marin County: **1**, Psilomelane occurs near Sausalito and Fort Baker, Lawson (7) p. 23. **2**, Psilomelane is found in masses on the Mailliard Ranch, about 8 miles northwest of San Rafael, W. W. Bradley et al. (4) p. 39.

Mendocino County: **1**, Large deposits of psilomelane occur in Potter Valley (sec. 3, T. 17 N., R. 12 W., M. D.), W. W. Bradley et al. (4) p. 40. **2**, It is reported to have been found in large amounts on Pieta Creek, near Pieta (N. R.). **3**, Deposits of psilomelane occur at the Cleveland mine, 3 miles east of Calpella, W. W. Bradley et al. (4) pp. 42, 43. **4**, At the Independent mine, 14 miles east of Willits, ibid. pp. 42, 43. **5**, It occurs in the hills east of the Middle Fork of Eel River, ibid. p. 40. **6**, Psilomelane with rhodochrosite occurs on Mount Sanhedrin, ibid. p. 44. **7**, Psilomelane in jasper is found at the Thomas and Wild Devil mines, about 6 miles northeast of Redwood Station, ibid. p. 46.

Merced County: **1**, Manganese ore deposits occur about 26 miles east of Tres Pinos (sec. 13, T. 13 S., R. 9 E., M. D.), W. W. Bradley et al. (4) p. 49.

Monterey County: **1**, Some small occurrences of psilomelane are found in the county, W. W. Bradley et al. (4) pp. 50, 51.

Napa County: **1**, Several small deposits of psilomelane occur near Oakville and Mount St. Helena, W. W. Bradley et al. (4) p. 51.

Nevada County: **1**, A large body of psilomelane occurs in the Limekiln district, E. M. Boyle (1) p. 262. **2**, It is widespread but not abundant in the Grass Valley mines, W. D. Johnston, Jr. (4) p. 44.

Placer County: **1,** Masses of psilomelane are found at Michigan Bluff (N. R.). **2,** Deposits of psilomelane occur about 9 miles north of Colfax, near Yankee Jims, W. W. Bradley et al. (4) p. 52.

Plumas County: **1,** Small amounts of psilomelane occur on Mumford Hill, W. W. Bradley et al. (4) pp. 53, 54. **2,** Psilomelane, manganite, and rhodonite occur in the Diadem and Penrose lodes, near Edmanton, in the Meadow Valley district, W. W. Bradley et al. (4) pp. 53, 54. **3,** Deposits of it occur near Crescent Mills, ibid. Other localities, J. C. O'Brien (1) pp. 80, 87.

Riverside County: **1,** Many small deposits occur in the McCoy Mountains, Palen Mountains, near Perris and Elsinore, Palo Verde, and Little Maria Mountains, W. W. Bradley et al. (4) pp. 54-59, E. L. Jones, Jr. (1) pp. 195, 199. **2,** Botryoidal psilomelane is reported from near Tadpole Tanks, Anon. (13), p. 15.

San Benito County: **1,** Minor stringers and coatings of psilomelane occur with benitoite near the headwaters of the San Benito River, Louderback and Blasdale (5) p. 363. **2,** It occurs in cherts on the Fries and Lewis Ranches about 18 miles east of Tres Pinos, Crawford (1) pp. 644, 645. **3,** It is found at the McCreary Ranch (sec. 29, T. 14 S., R. 9 E., M. D.), I. F. Wilson (2) p. 265.

San Bernardino County: **1,** Good specimens have come from Wagner, Mojave Desert (N. R.). **2,** Massive asbolite has been found with gypsum in clay in the Borate district, 7 miles north of Yermo (N. R.). References to other localities: W. W. Bradley et al. (4) pp. 61-64; Cloudman et al. (1) p. 822; E. L. Jones, Jr. (1) pp. 189, 190; Tucker and Sampson (17) p. 337; (28) p. 241; (32) pp. 67, 132.

San Diego County: **1,** Fine specimens have come from Campo (N. R.).

San Joaquin County: **1,** Psilomelane is found in the manganese ore deposits of the Diablo Range, notably at the Ladd mine in Corral Hollow, Watts (1) p. 564, P. D. Trask et al. (4) p. 86.

San Luis Obispo County: **1,** Psilomelane occurs on the Staneuch Ranch, 8 miles west of San Luis Obispo, W. W. Bradley et al. (4) p. 72.

Santa Clara County: **1,** The outer crust of the manganese ore boulder near Alum Rock Park, 5 miles east of San Jose, was psilomelane, A. F. Rogers (21) p. 447. Other occurrences: W. W. Bradley et al. (4) pp. 75-81.

Shasta County: **1,** A deposit of psilomelane occurs on the Pit River, 1 mile south of Heroult, G. C. Brown (2) p. 807. **2,** It occurs with jasper in Arbuckle Mountain (N. R.).

Siskiyou County: **1,** Many small occurrences are listed by W. W. Bradley et al. (4) p. 82.

Sonoma County: **1,** A deposit of high-grade psilomelane occurs on the Shaw Ranch, 7 miles northwest of Cloverdale, Crawford (1) p. 330. Other small deposits: W. W. Bradley et al. (4) pp. 82, 83.

Stanislaus County: 1, It occurs on Arroyo del Puerto, west of Patterson, W. W. Bradley et al. (4) p. 84. **2,** In the manganese ore deposits of the Diablo Range, notably at the Buckeye mine, west of Vernalis, L. A. Smith (1) p. 213.

Trinity County: **1,** A number of small prospects: W. W. Bradley et al. (4) p. 89, Averill (10) pp. 67, 68, J. C. O'Brien (1) p. 84.

Tulare County: **1**, Melhase (3) No. 7, p. 23 has reported the occurrence of asbolite from the King C. Gillette farm, near Lindsay. **2**, Asbolite has been reported from the chrysoprase workings near Deer Creek, Hamilton (4) p. 247.

Tuolumne County: **1**, It is found massive with pyrolusite near Columbia, D. T. Day (1) p. 554.

PTILOLITE

A calcium-potassium-sodium zeolite, perhaps
$(Ca,K_2,Na_2)O \cdot Al_2O_3 \cdot 10SiO_2 \cdot 5H_2O$(?)

Orthorhombic. Crystals usually very small, needles or blades. H. = 5. Colorless or white. Insoluble in HCl. Occurs as a secondary mineral in vesicular lavas; also in late phase pegmatites.

Los Angeles County: **1**, Ptilolite occurs in clusters of capillary crystals, with heulandite, locality 9, Cahuenga Pass, Neuerberg (1) p. 158.

Riverside County: **1**, Ptilolite occurs as radiating clusters of slender needles and thin blades, coating calcite on fracture surfaces of diopside-wollastonite contact rock in the 910-level at Crestmore, Murdoch (p.c. '51), and in lathlike crystals also on broad fracture surfaces in the contact rock of the 910 level at Crestmore, Murdoch (p.c. '53).

PUCHERITE

Bismuth vanadate, $BiVO_4$

Orthorhombic. Tabular and acicular crystals. Perfect basal cleavage. Color reddish brown. Streak yellow. H. = 4. G. = 6.25.

Fused on charcoal with mixture of potassium iodide and sulphur, a red sublimate is obtained mixed with greenish yellow. The phosphorous salt bead of vanadium is yellow in the oxidizing flame and emerald green in the reducing flame. Soluble in hydrochloric acid.

San Diego County: **1**, Pucherite occurs at the Pala Chief mine, near Pala. It was analyzed by Schaller (25) p. 230. **2**, It occurred at the Victor mine, Rincon, with bismite and bismutite (?) Palache, et al. p. 600.

PUMPELLYITE

Hydrous calcium aluminum silicate, $Ca_4Al_5(Mg,Fe)Si_6O_{23}(OH)_3 \cdot 2H_2O$

Monoclinic. In minute fibers or narrow plates. One good cleavage. Color green or brown. H. = 5½. G. = 3.2.

Marin County: **1**, Crystalline pumpellyite has come from 2 miles east of Novato, Vonsen (p. c., '45).

San Benito County: **1**, Pumpellyite occurs in association with jadeite and lawsonite on Clear Creek, Yoder and Chesterman (1) p. 3.

San Mateo County: **1**, Pumpellyite has been reported in quartzo-feldspathic rocks, Hutton (1) p. 1373.

Sonoma County: **1**, Pumpellyite was reported from two localities in the county. 1, Dull-green pumpellyite occurs with lawsonite in veins in glaucophane schist at Porter Creek [not at Mill Creek], 2 miles northwest of River Road, 8½ miles southwest of Healdsburg. Irving et al. (1) p. 338. **2**, Brown fibrous pumpellyite occurs in tufts or radiating aggregates in glaucophane schist near Skaggs, ibid. p. 338. **3**, Pumpellyite is reported from Mill Creek, Combs (1) p. 119. This may well be the same locality as reported by Irving et al. (1), as being Porter Creek.

Trinity County: **1**, Pale green veinlets of fibrous pumpellyite have been found in NW¼ sec. 21, T. 28 N., R. 11 W., M. D., F. S. Simons (p. c. '41).

PURPURITE

Hydrous iron and manganese phosphate, $(Fe,Mn)_2O_3 \cdot P_2O_5 \cdot H_2O$

Orthorhombic. In small irregular masses. One cleavage. Satin luster. Color deep red or purple. H. = 4-4½. G. = 3.4.

Similar to vivianite in reactions. Yields a blue green bead of manganese with sodium carbonate.

San Diego County: **1**, Purpurite was found with lithiophilite and triphylite in a pegmatite dike on Heriart Hill at Pala, Graton and Schaller (1) p. 146, Kunz (26) p. 1344, Schaller (22) p. 79. **2**, A purple alteration product, either purpurite or heterosite (called heterosite by Jahns and Wright (5) p. 31), is the same occurrence reported by Schaller from Hiriart Hill, Pala. Heterosite is considered to be the iron-rich end member of the purpurite-heterosite series.

PYRARGYRITE—Dark Ruby—Silver Ore

Silver antimony sulfide, Ag_3SbS_3

Hexagonal-rhombohedral. Prismatic crystals; also massive. Cleavage distinct. Brittle. Metallic luster. Color grayish black, or dark red. Streak purplish red. H. = 2½. G. = 5.85.

Gives a white antimony oxide coating on charcoal and reduces to a globule of metallic silver. The sulphur can best be detected by fusion in a closed tube.

Pyrargyrite is found in silver veins with argentite, polybasite, stephanite, tetrahedrite, and other silver minerals. It is often embedded in quartz and good crystals of pyrargyrite may occur in cavities in quartz.

Alpine County: **1**, Pyrargyrite occurred in the old I X L and Exchequer mines of the Silver Mountain district, R. W. Raymond (6) p. 13, Wheeler (4) p. 184, Hanks (15) p. 129, Lindgren (20) p. 184, Eagle (16) p. 13. **2**, It was observed in the Monitor mining district (Morning Star mine) Eakle (16) p. 13.

Kern County: **1**, It was found with argentite at the Amalie mine, S. M. B. (14831). **2**, At the Reform mine (sec. 6, T. 29 S., R. 33 E., M. D.), Tucker and Sampson (21) p. 323. **3**, In the Sumner district, 1 mile north of Kernville, Wheeler (3) p. 65.

Mariposa County: **1**, It was found with argentite and proustite in the Bryant silver and Silver Lane mines (sec. 15, T. 6 S., R. 19 E., M. D.), Laizure (6) p. 123. **2**, Reported from the Washington and Georgia mine, Quartzburg, J. B. Trask (1) p. 24.

Mono County: **1**, Pyrargyrite and stephanite were abundant in the Oro, Addenda, Fortuna, and other mines south of Bodie, Hanks (12) p. 315. Crystals of pyrargyrite were found in a vug in the Bodie mine, Whiting (1) p. 392. **2**, It also occurred in the Blind Spring Hill mines, in the Tower mine, and in other mines near Benton, Whiting (1) p. 392, R. J. Sampson (14) p. 140. **3**, Pyrargyrite was found at the Dunderberg mine, Castle Peak, Conkling (1) p. 184.

Napa County: **1**, It is a constituent of the gold and silver ore in the Palisades mine, 2 miles north of Calistoga, W. W. Bradley (26) p. 195. **2**, With cinnabar at the Elephant vein 1½ miles north of Calistoga, Becker (4) p. 370.

Nevada County: **1**, It was found with pyrite, chalcopyrite, and galena in the Allison Ranch mine, Lindgren (12) p. 119, W. D. Johnston, Jr. (3) p. 27. **2**, Pyrargyrite occurs in the Central mine of the Lava Cap Company, south of Banner Hill, and is probably present in other mines of the Grass Valley and Nevada City district as indicated by the silver-rich concentrates, W. W. Bradley (30) p. 364, W. D. Johnston, Jr. (3) p. 216 (S. M. B. 21054).

Placer County: **1**, It occurs in gold quartz at the Three Stars mine, Ophir district, S. M. B. (16416).

San Bernardino County: **1**, Pyrargyrite occurs with miargyrite in the silver ores of the Rand district, Hulin (1) p. 98. **2**, With wolframite in Cliff Canyon, 2 miles southeast of Brant, New York Mountains, Tucker (4) p. 373. **3**, At the Carlyle mine, Dale district, with polybasite and stephanite, Tucker and Sampson (27) p. 61. **4**, Sparingly in the Calico district, Weeks (4) p. 533.

Shasta County: **1**, Small amounts of pyrargyrite were occasionally found in the mines near Igo (N. R.).

Tulare County: **1**, Pyrargyrite occurred in minor amounts in the Empire mine, Mineral King district, Engineering and Mining Journal (6) p. 8.

PYRITE—Iron Pyrites

Iron disulphide, FeS_2

Isometric. Crystals common; usually cubes, pyritohedrons and octahedrons. Generally compact and granular massive. Brittle. Metallic luster. Color brass yellow. Streak greenish black. H. = 6-6½. G. = 5.

Easily fusible. Roasted on charcoal, it burns with a blue flame and gives a strong sulphur odor. The residue becomes magnetic. Soluble in nitric acid and reddish ferric hydrate is precipitated by ammonia.

Melnikovite is a cryptocrystalline variety of pyrite.

Pyrite is the commonest of the sulphide minerals and is found in all kinds of rock, but is especially prominent in metamorphic schists, slates, and quartzites, and in unaltered sandstones. It is commonly found in distinct crystals and in granular masses. Cubes several inches in diameter are frequent in gold districts, but in general the smaller crystals and granular masses are more highly auriferous. All of the localities given for chalcopyrite and many more, might be cited for pyrite since it is present in every county. The oxidation of pyrite produces limonite and hematite, and the gossan of mineral veins is mostly formed by its alteration. Cubes of limonite as pseudomorphs after pyrite are exceedingly common.

Alameda County: **1**, Well-developed crystals from the Alma mine, Leona Heights, have been measured by Schaller (1) p. 191. C. W. Clark (1) p. 374 gives a list of minerals, including pyrite, at the Alma mine.

Alpine County: **1**, Melnikovite (cryptocrystalline pyrite) occurs at the Leviathan mine, Pabst (6) p. 425.

Calaveras County: **1**, Cubes and pyritohedrons of pyrite occur with the gold on Carson Hill, A. Knopf (11) p. 39, and slender needles from the Stanislaus mine are described as distorted pyrite crystals by A. W. Jackson, Jr. (3) p. 365. Good cubes are found at Murphy in the Masonia mine (N. R.).

Colusa County: **1**, Hexagonal plates of pyrite occur as pseudomorphs after pyrrhotite at the Sulphur Creek deposit, Genth (9) p. 40.

El Dorado County: **1**, Blake reported brilliant cubes at the Mameluke mine near Georgetown, Hanks (12) p. 317.

Mariposa County: **1**, Large and perfect crystals occur in the slates near Princeton Hill, Hanks (12) p. 317.

Nevada County: **1**, Pyrite forms the substance of fossilized trees at French Corral, J. A. Phillips (2) p. 408.

Riverside County: **1**, Pyrite is present in the Crestmore limestone as grains, cubes, and pyritohedrons; some of the crystals are large. Limonite pseudmorphs after the pyrite are common, Eakle (15) p. 352.

San Diego County: **1**, Gel-like veins of pyrite occur cutting the pyrrhotite mass at the Friday mine, Creasey (1) p. 27.

Santa Clara County: **1**, Slender prismatic crystals from the New Almaden cinnabar mine were measured by A. W. Jackson, Jr. (3) p. 371.

Shasta County: **1**, It was found by A. L. Day and Allen (1) pp. 121, 137, in the hot springs and mud pots of Lassen Volcanic National Park. **2**, Pyrite used for sulphuric acid occurs in commercial quantities and is produced at the Hornet mine in the NE$\frac{1}{4}$ sec. 34, T. 33 N., R. 6 W., M. D., Aubury (1) p. 68, Tucker (9) p. 441. **3**, Pyrite is the most abundant sulfide in the ores of the Iron Mountain mine, associated with chalcopyrite and sphalerite. Kinkel, A. R., Jr. and Albers, J. P. (1) p. 9.

Sonoma County: **1**, Large octahedrons have been found on Austin Creek, near Healdsburg (N. R.).

Tuolumne County: **1**, Fine crystals were found in the Patterson mine, Tuttletown, Hanks (12) p. 318.

PYROCHLORE

Niobate of the cerium metals, calcium, and other bases, with titanium, thorium, fluorine

Isometric. Commonly in octahedrons. Cleavage octahedral. Brittle. Luster vitreous or resinous. Color dark reddish brown. Streak light yellowish brown. H. = 5-5½. G. = 4.2-4.36.

Infusible and insoluble. Fused with borax, the powdered fused mass may be dissolved in hydrochloric acid. If metallic tin is added and the solution boiled down to small bulk, the color of the solution becomes at first violet, due to titanium, and then blue, due to the niobium.

San Diego County: **1**, A dark-brown isotropic mineral, presumably pyroclore, surrounded by microlite, came from some locality in the county, A. F. Rogers (7) p. 375.

PYROCHROITE

Manganese hydroxide, $Mn(OH)_2$

Hexagonal-rhombohedral. In hexagonal plates. Perfect basal cleavage. Pearly luster. Color white, but alters to brown and black. H. = 2½. G. = 3.26.

B.B. infusible. Heated in a closed tube, it becomes green, then black, and yields water. Gives green bead with sodium carbonate.

Santa Clara County: **1**, Pyrochroite was a prominent constituent of a boulder of manganese ore near Alum Rock Park, 5 miles east of San Jose, A. F. Rogers (21) p. 445.

PYROLUSITE

MnO_2

Commonly with a little non-essential water. Tetragonal. Color iron gray to black. H. = 2-2½. G. = 4.7-4.8. Compact dense masses, botryoidal; crystals usually prisms pseudomorphous after manganite. Soluble in hydrochloric acid with evolution of chlorine. May give a little water in the closed tube.

It is the commonest of the manganese minerals, but may readily be confused with "wad," or if in compact form, with others of the "psilomelane type." Common in the surface portions of manganese deposits, and very pervasive as coatings on fracture surfaces, and associated with other oxides. Its occurrences are practically the same as those of manganese ores or prospects, and are treated in considerable detail in Bulletins 76 and 125 of the State Division of Mines. Hanks (12) p. 316, also gives an extensive list of localities.

Alameda County: **1**, Pyrolusite occurs with psilomelane in the Corral Hollow and Arroyo Mocho manganese deposits, Huguenin and Castello (4) pp. 26-28.

Calaveras County: **1**, Good specimens of pyrolusite have come from San Andreas (N. R.).

Colusa County: **1**, Pyrolusite found with cinnabar at Stonyford, S. M. B. (9133).

Contra Costa County: **1**, It occurs with psilomelane on Red Rock in San Francisco Bay, J. D. Whitney (1) p. 79.

Del Norte County: **1**, It occurs with manganite on the North Fork, Smith River, Maxson (1) p. 160.

El Dorado County: **1**, Masses of it occur at Greenwood, S. M. B. (12153).

Humboldt County: **1**, Pyrolusite occurs on the Porter Ranch, Fort Baker, W. W. Bradley et al. (4) p. 33.

Imperial County: **1**, It is found with manganite at Tolbard (T. 11 S., R. 21 E., S. B.), Tucker (11) p. 266, Hadley (1) p. 465.

Lake County: **1**, It occurs with psilomelane at the Phillips mine near Laurel Dell, Huguenin and Castello (4) p. 79.

Lassen County: **1**, Pyrolusite is rather abundant in the gold ores of the Hayden Hill district, Hill (2) p. 36.

Madera County: **1**, It occurs with limonite 14 miles from Fresno Flat, Laizure (9) p. 55. **2**, Near Coarse Gold with psilomelane, manganite, rhodochrosite, and rhodonite, (N. R.).

Marin County: **1**, Small amounts of pyrolusite were found in the rock at Sausalito, Hanks (12) p. 316.

Mariposa County: **1**, Small masses of pyrolusite occur in Hunters Valley, S. M. B. (467).

Mendocino County: **1**, Pyrolusite is found at Red Mountain. **2**, It occurred with psilomelane at the Independence manganese mine, Potter Valley. **3**, Near Covelo. **4**, 4 miles west of Hopland with psilomelane. **5**, In Redwood Valley. **6**, Near Willits. **7**, At the Long mine near Woodman Station. **8**, In chert at Westport. **9**, At the Cleveland mine, Ukiah. General reference for the county, W. W. Bradley et al. (4) pp. 39-49.

Napa County: **1**, Pyrolusite occurred as radiate concentric masses with cinnabar at the old Redington and Manhattan mines, Knoxville (N. R.).

Placer County: **1**, Pyrolusite occurs with rhodonite 12 miles from Auburn on Wolf Creek road, S. M. B. (12152).

Plumas County: **1**, It is common near the Diadem lode, Meadow Valley district, Turner (17) p. 6.

Riverside County: **1**, It occurs with manganite and psilomelane in the McCoy Mountains, E. L. Jones, Jr. (1) p. 197.

San Benito County: **1**, It replaces jasper at the Cleveland manganese mine, 20 miles east of Tres Pinos, Crawford (1) p. 330.

San Bernardino County: **1**, Pyrolusite occurs in the Calico and Barstow districts, Erwin and Gardner (3) p. 301. **2**, It occurred with psilomelane in the Emma and Owls Hole mines, in the Owl Mountains, Cloudman et al. (1) p. 823. Other references to this county: E. L. Jones, Jr. (1) p. 199; Tucker and Sampson (28) p. 241, (33) pp. 132, 135.

San Joaquin County: **1**, It is found in the manganese deposits of the Diablo Range, Watts (1) p. 564.

San Luis Obispo County: **1**, Pyrolusite is found with psilomelane in the manganese deposits on the Staneuch Ranch, 8 miles west of San Luis Obispo, W. W. Bradley et al. (4) p. 72.

Santa Clara County: **1**, Pyrolusite was found at the Washington mine, and in the mines of the Diablo Range, W. W. Bradley et al. (4) pp. 75-80.

Sonoma County: **1**, It occurred at the Shaw mine, Crawford (1) p. 330.

Stanislaus County: **1**, Soft botryoidal pyrolusite and psilomelane form the ore of the Seagrave mine, (N. R.). **2**, Pyrolusite occurs with rhodochrosite at the Buckeye mine on Hospital Creek, Laizure (3) p. 213.

PYROMORPHITE

Lead chloro-phosphate, $(PbCl)Pb_4(PO_4)_3$

Hexagonal. Prismatic crystals; often globular, reniform, and botryoidal. Brittle. Resinous luster. Color green, yellow, brown; also grayish white to milk white. Streak white. H. = $3\frac{1}{2}$-4. G. = 6.5-7.1.

Fuses easily on charcoal and yields a lemon-yellow coating when reduced. The phosphate reaction can be obtained by dissolving pyromorphite in nitric acid and adding to ammonium molybdate.

Pyromorphite is found as an alteration product of galena and cerussite.

Calaveras County: **1**, Green crystals of pyromorphite have been found in gold quartz at the Reliance mine, (N. R.).

El Dorado County: **1**, It occurred as yellowish-green coloring matter in botryoidal chalcedony and as a crystalline coating, at Mosquito Gulch, 6 miles northeast of Placerville, Turner (22) p. 343.

Inyo County: **1**, It was found in small amounts in the Cerro Gordo district, R. W. Raymond (10) p. 29. **2**, Euhedral crystals of pyromorphite have been found at Darwin, in oxidized lead ore, in the Surprise mine sec. 20, T. 19 S., R. 42 E., M.D., C. D. Woodhouse (p.c. '47), Norman and Stewart (2) p. 81.

Mariposa County: **1**, A small amount of pyromorphite was found in the mines near Coulterville, and is represented by a specimen in the University of California Collection at Berkeley.

Mono County: **1**, Prisms of pyromorphite on quartzite have come from Log Cabin Mining Company, 3 miles west of Mono Lake, W. W.

Bradley (29) p. 311. 2, Minute crystals lining a cavity have been found in the Blind Spring Hill district, W. W. Bradley (29) p. 191.

Nevada County: 1, Pyromorphite occurs with galena in quartz at the Rocky Glen mine, Whiting (1) p. 450, Irelan (4) p. 47.

Riverside County: 1, The mineral reported from the El Dorado mine has been proved to be vanadinite, Pabst (p. c. '45).

San Bernardino County: 1, Pyromorphite has been found with vanadinite at the Vanadium King mine, near Kleinfelter, Tucker (4) p. 375.

Shasta County: 1, W. P. Blake (14) p. 125 reported the occurrence of pyromorphite with tetrahedrite, galena, and cerussite on the Chicago claim, 3 miles west of Igo.

Tulare County: 1, It was found in the White Chief mine, Mineral King district, Goodyear (3) p. 646, Schrader et al. (1) p. 71.

PYROPE

See garnet

PYROPHYLLITE

Hydrous aluminum silicate, $Al_2Si_4O_{10}(OH)_2$

Orthorhombic. Foliated, radiated lamellar, fibrous; also granular to compact. Cleavage, perfect basal. Pearly luster. Color white, apple green, light brown, gray. H. = 1-2. G. = 2.8-2.9.

Fuses usually with exfoliation. Moistened with cobalt nitrate and intensely heated, assumes a blue color. Gives a little water in a closed tube. Partially decomposed by hydrochloric acid. Soft and greasy like talc, but distinguished by the reaction for aluminum.

Some *agalmatolite* is pyrophyllite.

Alameda County: 1, A specimen from Irvington is in the State Division of Mines Exhibit, S. M. B. (16214).

Amador County: 1, Pyrophyllite (or damourite?) is one of the gangue minerals of the Central Eureka and Kennedy mines, Logan (16) p. 78.

El Dorado County: 1, It is reported from the county, S. M. B. (1811).

Imperial County: 1, Pyrophyllite occurs in veins with kyanite and andalusite at the mine of the Vitrefrax Corporation, near Ogilby, Tucker (11) p. 280.

Inyo County: 1, Pyrophyllite has been found near Sheephead Pass, 7 miles west of Shoshone, W. W. Bradley (30) p. 194. 2, Pyrophyllite has been shipped from a deposit 17 miles north of Laws, Calif. Div. Mines, Mineral Inf. Service, April 7, 1947.

Madera County: 1, Radiating and massive pyrophyllite occurs in schist near the junction of the North Fork of San Joaquin River and Bench Creek, Erwin (1) p. 29.

Mariposa County: 1, Pyrophyllite occurs in beautiful radiating tufts of golden yellow color with quartz at Tres Cerritos, Hanks (12) p. 318, Turner (12) p. 685.

Mono County: 1, Pyrophyllite occurs abundantly in radiating masses and veinlets in andalusite at the mine of Champion Sillimanite, Incorporated, on the western slope of the White Mountains, 7 miles east of Mocalno, Peck (1) p. 151, Kerr (3) p. 627.

Plumas County: 1, Massive pyrophyllite occurs in the Diadem Lode, Meadow Valley, Schrader et al. (1) p. 71.

San Bernardino County: 1, A considerable deposit of pyrophyllite occurs in a hydrothermally altered zone in volcanic rock on the Victorite pyrophyllite property, secs. 24, 25, T. 7 N., R. 3 W., S. B., near Victorville, Wright et al. (5) p. 243.

San Diego County: 1, Agalmatolite occurs near Encinitas, A. F. Rogers (7) p. 381, Sanford and Stone (1) p. 24. 2, A large commercial deposit of massive pyrophyllite occurs near Escondido, D. F. Palmer (p. c. '45). Additional information places this occurrence at the Pioneer mine, 7½ miles southwest of Escondido, Jahns and Lance (3), pp. 1-32, D. F. Palmer (1) p. 5.

San Luis Obispo County: 1, Massive pyrophyllite from the county is represented by S. M. B. (4060).

PYROSTILPNITE—Fireblende

Silver antimony sulphide, Ag_3SbS_3

Monoclinic (?). Crystals lathlike or tabular. One perfect cleavage. Slightly flexible in thin plates. H. = 2. G. = 5.94. Luster adamantine. Color hyacinth red. Streak orange yellow. Blowpipe properties the same as pyrargyrite.

San Bernardino County: 1, A few minute crystals have been found in cavities of the rich silver ores at the California Rand mine, Murdoch (12) p. 130, W. W. Bradley (30) p. 194.

PYROXENES

In this group is a series of complex silicates of magnesium, iron calcium and aluminum, or varying combinations of these elements. They are very common rock-forming minerals and are found both in igneous and metamorphic rocks. They are so common that only the most interesting occurrences can be mentioned.

The following is a common classification of the pyroxenes giving species (S) and varietal (V) names:

- Enstatite (S)
  - Bronzite (V)
- Hypersthene (S)
  - Clinoferrosilite (V)
- Diopside (S)
  - Omphacite (V)
  - Diallage (V)
  - Hedenbergite (S)
  - Augite (S)
- Soda Pyroxenes
  - Acmite (S)
  - Jadeite (S)
  - Aegirite (S)

AUGITE

Augite is a dark-green to black aluminous pyroxene. It is the commonest of all the pyroxenes, and is an essential constituent of diorites, gabbros, diabases, basalts, andesites, pyroxenites, and other basic eruptives. It is mentioned in all petrographic descriptions of basic igneous rocks.

No occurrences are of sufficient interest to warrant a separate entry.

ENSTATITE

Magnesium silicate, $MgSiO_3$

Orthorhombic. Prismatic. Generally massive, lamellar. Cleavage perfect prismatic. Brittle. Pearly to vitreous luster. Color greenish or brownish gray to brown. Streak uncolored, grayish. H. = 5½. G. = 3.1-3.3.

Practically infusible and insoluble. Its constituents can be determined only in the wet way.

Bronzite is a variety in which part of the magnesium is replaced by iron. It occurs in bronze-brown reticulated masses.

Enstatite is a rock-forming mineral which is characteristic of gabbros, and rocks that have been derived from gabbros, like much of the serpentinized rocks of the Coast Ranges and Sierra Nevada. It is a common mineral, but has seldom been mentioned.

Alameda County: **1**, Bronzite occurs in some of the rocks of the Berkeley Hills, Hanks (12) p. 178.

Contra Costa County: **1**, Massive enstatite is found in the Diablo Range in this and other counties to the south, Kunz (24) p. 81.

Kern County: **1**, Bronzite was one of the constituents of the San Emigdio meteorite, and was analyzed by Whitfield (3) p. 114.

Nevada County: **1**, Enstatite is an important constituent of the gabbros of Nevada City, Lindgren (12) p. 53.

San Francisco County: **1**, Enstatite occurs abundantly in the serpentine of San Francisco, W. P. Blake (7) p. 307, Palache (2) p. 166, Eakle (1) p. 316, Kunz (24) p. 81.

HYPERSTHENE
Iron and magnesium silicate, $(Fe,Mg)SiO_3$

Orthorhombic. Prismatic; often tabular. Generally massive, foliated. Prismatic cleavage distinct. Brittle. Pearly to vitreous luster. Color brownish green to brown. Streak grayish. H. = 5-6. G. = 3.4-3.5.

B.B. fuses to a black enamel and on charcoal yields a magnetic mass. Partially decomposed by hydrochloric acid.

Hypersthene is a constituent of basic eruptive rocks, especially gabbros and andesites.

Plumas County: **1**, Hyperthene is a constituent of the hypersthene andesite at La Porte, Turner (4) p. 488.

San Diego County: **1**, It is one of the minerals in the orbicular gabbro at Dehesa, Lawson (6) p. 386.

Siskiyou County: **1**, It is mentioned by J. D. Dana (3) p. 254 as a constituent of the hypersthene andesite of Mount Shasta.

Trinity County: **1**, Hypersthene with magnetite, is abundant on the northwest side of Chuachelulla Mountain, G. C. Brown (2) p. 920.

CLINOFERROSILITE
$FeSiO_3$

The pure iron member of the series $(Fe,Mg)SiO_3$. Characteristic of lithophysae in obsidians.

Inyo County: **1**, Found as needles in lithophysae in obsidian from Coso Mountains, Bowen (1) p. 491, W. W. Bradley (29) p. 107.

DIALLAGE
Near diopside in composition, but usually with more or less aluminum

It is characterized by a very perfect cleavage [parting] in one direction, and a hardness of about 4. Diallage is the common pyroxene of gabbro.

Contra Costa County: **1**, Gabbro containing a high proportion of pure diallage, occurs on Bagley Creek about 1½ miles due north of the peak of Mt. Diablo, H. W. Turner (1) p. 391.

Nevada County: **1**, Diallage is common at Grass Valley and Nevada City, Lindgren (12) p. 52.

Riverside County: **1**, A little diallage occurs in the garnet contact rock, and in the quartz monzonite, at Crestmore, Daly (1) p. 649.

San Francisco County: **1**, Grains of diallage occur in the serpentine of San Francisco, with residual olivine and enstatite, Palache (2) p. 166, Lawson (2) p. 447.

DIOPSIDE
$CaMg(SiO_3)_2$

Diopside is white to grass green or purple (*violan*) and is characteristic of crystalline limestones, metamorphosed eruptives, and some schists. *Omphacite* is a variety commonly occurring in contact metamorphic rocks.

Contra Costa County: **1**, Diopside is common with albite in the schists near San Pablo, Blasdale (1) p. 343.

El Dorado County: **1**, Fine dark-green crystals of diopside occur near Mud Springs, Hanks (12) p. 318, Kunz (4) p. 80. **2**, Fine crystals have come from the old Cosumnes copper mine, near Fairplay, Hanks (12) p. 319, Kunz (24) p. 80. **3**, Massive white diopside, resembling idocrase, and lathlike crystals up to 7 millimeters occur with prehnite on West Hill, Traverse Creek, 2½ miles southeast of Georgetown, Pabst (2) p. 3.

Fresno County: **1**, Pink, white, and dull-gray crystals of diopside occur in limestone in the Twin Lakes area, Chesterman (1) p. 254.

Inyo County: **1**, Pale-green diopside is found in a contact zone at Round Valley, 6 miles west of Bishop, Chapman (1) p. 866. **2**, Colorless diopside, with scapolite and idocrase is found at the Pine Creek tungsten mine, Hess and Larsen (17) p. 276.

Lake County: **1**, Violan is reported from Big Canyon (N. R.).

Madera County: **1**, Diopside is common in contact zones in limestone on Shadow and Johnson Creeks, in the Minaret district, Erwin (1) p. 30.

Placer County: **1**, Diopside, showing crystals in cavities, is found associated with axinite and black tourmaline just below the summit of Wards Peak, Wilke (p.c. '36).

Riverside County: **1**, Diopside is abundant in the contact zones at Crestmore, Eakle (15) p. 340, Merriam and Laudermilk (1) p. 715, Woodford (11) p. 359. Complex crystals were measured by Eakle (15) p. 340. **2**, Large green crystals of diopside appear in the contact zone at the New City quarry, south of Riverside, Larsen (17) p. 34. **3**, Coarse-grained diopside with garnet occurs at a limestone-gabbro contact 1½ miles northeast of Winchester, ibid., p. 35.

San Bernardino County: **1**, Snow-white, fine-grained diopside occurs near the mouth of Cascade Canyon (SE¼ sec. 36, T. 2 N., R. 8 W., S. B.), Merriam and Laudermilk (1) p. 716. **2**, Granular pale-blue diopside found in contact zone above main adit of Ball magnesite mine 12 miles east of Victorville. Bowen (p.c. '55).

San Francisco County: **1**, Lilac-colored diopside in fibrous and columnar radial groups occurs in seams of serpentine near San Francisco, Sterrett (6) p. 864.

HEDENBERGITE
$CaFeSi_2O_6$

Fresno County: **1**, Hedenbergite is the principal skarn mineral with scheelite, magnetite, and garnet, in a contact deposit in the Twin Lakes district, Chesterman (1) p. 277.

Shasta County: **1**, Green, fibrous hedenbergite, associated with ilvaite occurs at Potters Creek, in an iron-ore deposit, Prescott (1) p. 14, (2) p. 473.

Soda Pyroxenes

ACMITE—AEGIRITE

Sodium and iron silicate, essentially $NaFe(SiO_3)_2$

Monoclinic. Prismatic crystals. Cleavage prismatic distinct. Brittle. Vitreous luster. Color brown or dark green. Streak pale yellowish gray. H. = 6-6½. G. = 3.50-3.55.

Fuses quietly to a globule which is slightly magnetic, and gives a yellow sodium flame. Nearly insoluble.

Acmite (aegirite) is a rock-forming mineral prominent in some syenites.

Fresno County: **1**, Aegirite occurs with analcime and barkevikite, in cavities of a soda syenite, near the head of White Creek (SE¼ sec. 4, T. 19 S., R. 13 E., M. D.), Arnold and Anderson (8) p. 158.

San Benito County: **1**, Aegirite occurs in stellate groups with benitoite and natrolite in the albite at the benitoite locality near the headwaters of the San Benito River, Louderback and Blasdale (5) p. 363. **2**, A specimen of rock containing prisms of acmite was found near Hollister (N. R.).

San Diego County: **1**, It occurs with quartz, crossite, and garnet in schist boulders in the San Onofre breccia on the state highway due west of San Onofre Mountain, Woodford (2) p. 186.

Sonoma County: **1**, Black stumpy crystals of aegirite occur with riebeckite in cavities of soda rhyolite, near Glen Ellen on the east side of Sonoma Valley, Chesterman (p.c. '51).

JADEITE

Silicate of sodium and aluminum, $NaAl(SiO_3)_2$

Monoclinic, prismatic. Granular, compact. Cleavage, prismatic. Parting difficult, fracture splintery. Extremely tough. H. = 6.5-7. G. = 3.3-3.5. Luster sub-vitreous, pearly on cleavage surfaces. Color apple green to emerald green, bluish green, leek green, greenish white and nearly white; sometimes white with spots of bright green. Translucent to sub-translucent.

Marin County: **1**, Jadeite occurs as an important constituent of weakly metamorphosed graywacke at Massa Hill nephrite locality, Chesterman (p.c. '55).

Mendocino County: **1**, Jadeite occurs in stream boulders, with nephrite and with crocidolite, on the north fork, Eel River, near Mina, Yoder and Chesterman (1) p. 6, Anon. (12) p. 2. **2**, Stream boulders of jadeite are found in Williams Creek, Yoder and Chesterman (1) p. 6.

San Benito County: **1**, Boulders of jadeite, and nodules in serpentine associated with pumpellyite and lawsonite, have been found on Clear Creek, NW¼ sec. 12, T. 18 S., R. 11 E., M. D., Anon. (9) (5) p. 2. Description of the original find, Bolander (2) p. 186, with comments, Dake (1) p. 188; Yoder and Chesterman (1) p. 1; Coleman, Robt. G. (1) p. 11.

San Luis Obispo County: **1**, Stream boulders of jadeite have been found near Paso Robles, Yoder and Chesterman (1) p. 6.

Sonoma County: **1**, Doubly terminated crystals of jadeite, occur along Russian River near Cloverdale, Wolfe and Riska (1) p. 1491, Wolfe

(3). **2**, Jadeite occurs in schist at Valley Ford, Yoder and Chesterman (1) p. 6.

Trinity County: **1**, Stream boulders of jadeite with nephrite are reported from the north fork of the Eel River, Anon. (8), p. 16.

PYRRHOTITE—Magnetic Pyrites

Ferrous sulphide, $Fe_{1-x}S$

Hexagonal. Crystals rare. Commonly massive, either granular or compact. Brittle. Metallic luster. Color bronze brown. Streak grayish black. H. = $3\frac{1}{2}$-$4\frac{1}{2}$. G. = 4.58-4.64.

Usually magnetic, becoming more strongly so on heating. Dissolves in hydrochloric acid with evolution of hydrogen sulphide.

Pyrrhotite is often associated with pyrite, chalcopyrite, and arsenopyrite, and is sometimes found in large lenticular masses. It is common in the gold and copper districts although usually in small amounts. Occasionally it is accompanied by nickel minerals. Many minor occurrences exist besides those listed below.

Alpine County: **1**, Pyrrhotite ocecurs with other sulphides in a quartz vein near Red Lake Peak, 13 miles west of Woodfords, W. W. Bradley (15) p. 488.

Amador County: **1**, Pyrrhotite was found in albite veinlets at the Treasure mine near Amador City, A. Knopf (11) p. 39. **2**, It occurs at the Defender mine 5 miles southeast of Volcano, Tucker (1) p. 27. **3**, Found at the Argonaut mine, L. L. Root (2) p. 67.

Calaveras County: **1**, It occurs in the Westpoint and other districts, Turner (3) p. 470, Franke and Logan (4) p. 239. **2**, Pyrrhotite is disseminated in diorite at the Easy Bird mine, northeast of Mokelumne Hill, A. Knopf (11) p. 39. **3**, It is found in the Lockwood mine $1\frac{1}{2}$ miles northeast of Woodcocks Mill, Turner and Ransome (18) p. 6. **4**, It occurs with tetrahedrite at Carson Hill, Moss (1) p. 1011.

Del Norte County: **1**, Pyrrhotite is found in copper ores on Diamond Creek, Shelly Creek, Copper Creek, Low Divide district and other localities, Aubury (1) p. 112, (4) pp. 136, 139, Maxson (1) p. 148.

Fresno County: **1**, A very large mass of sulphide ore, mainly pyrrhotite, occurred on the 200-foot level of the Fresno copper mine (sec. 10, T. 12 S., R. 21 E., M. D.), Aubury (4) p. 281.

Humboldt County: Large masses of pyrrhotite occur at Elk Ridge, S. M. B. (12195).

Inyo County: **1**, Many small occurrences of pyrrhotite are found in the Panamint Range, R. J. Sampson (7) pp. 349, 367, 371, 373, Murphy (2) pp. 313, 317. **2**, West of Bishop, in Tungsten Hills and vicinity, it is associated with scheelite, Hess and Larsen (17) p. 269, Tucker and Sampson (32) p. 60. **3**, Pyrrhotite is found at the Bishop Creek and Wilshire Bishop Creek mines, Tucker (11) p. 474, Schroter (2) p. 53, Lenhart (1) p. 4.

Kern County: **1**, It occurs in contact deposits with scheelite in the Green Mountains (sec. 19, T. 25 S., R. 32 E., M. D.), Storms (15) p. 768, Hess and Larsen (17) p. 262. **2**, In the Big Blue group (T. 25 S., R. 33 E., M. D.), Prout (1) p. 413. **3**, It was one of the constituents of the San Emigdio meteorite, Whitfield (3) p. 114.

Los Angeles County: **1**, Pyrrhotite occurs with other sulphides, siderite and annabergite in Pacoima Canyon, 12 miles northeast of San Fer-

nando, Tucker (4) p. 318, (8) p. 42, R. J. Sampson (10) p. 176, D'Arcy (3) p. 269.

Madera County: **1**, It was found in the old Buchanan mine, Turner (12) p. 696. **2**, Large masses of pyrrhotite reported to carry several percent of cobalt and nickel occur about 12 miles northeast of Madera, R. P. McLaughlin and Bradley (3) p. 559. **3**, Pyrrhotite occurred at the Ne Plus Ultra mine near Daulton, Forstner (4) p. 747.

Marin County: **1**, Tabular crystals have been found on Mount Tamalpais (N. R.).

Mariposa County: **1**, Thick bodies of pyrrhotite occur in the Green Mountain mine, Forstner (4) p. 747. **2**, It occurs abundantly in the ore at the Croesus prospect on the Merced River, 2 miles north of Bagby, A. Knopf (11) p. 39. **3**, 1 mile north of Trumbull Peak, near Incline, W. W. Bradley (13) p. 84. **4**, It is present in the Iona Copper Company tunnel on Merced River, Hanks (12) p. 316.

Mono County: **1**, It is abundant in quartz at the Tioga mine, Turner (4) p. 469. **2**, It is found at Laurel Creek and upper Mammoth Valley, Mayo (4) pp. 84, 85.

Nevada County: **1**, Pyrrhotite was found in the mines of Grass Valley and Nevada City, Lindgren (12) p. 118, Knaebel (1) p. 393. **2**, It was also found in the Meadow Lake district, Conkling (1) p. 184, Lindgren (5) p. 205. **3**, It occurred massive at the Yuba mine, Washington district, Irelan (4) p. 47. **4**, It was reported in considerable quantity and said to carry platinum in the Liberty Hill district, Hill (3) p. 8.

Orange County: **1**, Found with sphalerite on the north bank of San Juan creek in the southwest part of the Elsinore quadrangle, about 1½ miles east of the western quadrangle boundary, Larsen, E. S. Jr., Everhart, D. L., Merriam, Richard (18), p. 48.

Plumas County: **1**, Pyrrhotite occurs in masses between sandstone and serpentine about 1½ miles south of Taylorsville, Diller (9) p. 47, (11) p. 115.

Riverside County: **1**, Minor amounts of pyrrhotite occur at Long Canyon (sec. 7, T. 6 S., R. 5 W., S. B.), R. J. Sampson (9) p. 514. **2**, In the old city quarry, Riverside, A. F. Rogers (19) p. 582. **3**, At Crestmore Kelley (2) p. 141. **4**, Occurs with siderite in the Old Dominion mine in the Santa Ana Mountains. Larsen, E. S., Jr., Everhart, D. L., Merriam, Richard (18), p. 48.

San Diego County: **1**, A large body of nickel-bearing pyrrhotite associated with chalcopyrite, pyrite, and violarite occurs on contact of gabbro and fine-grained mica schist, at the Friday copper mine (sec. 15, T. 13 S., R. 4 E., S. B.), Julian district, Calkins (2) p. 78, Hudson (1) p. 219, Creasey (1) p. 27. **2**, Pyrrhotite has been found near Descanso, Tucker (8) p. 371. **3**, At the Echo mine near Lakeside, W. W. Bradley (28) p. 495.

Santa Clara County: **1**, Pyrrhotite occurs in the ore of the Hooker Creek mine, sec. 10, T. 9 S., R. 1 W., M. D., 7 miles south of Los Gatos, F. F. Davis (p.c. '53).

Shasta County: **1**, It was found with the pyrite at some of the copper mines, and noticed at the Black Diamond copper mine and Sutro mines, Tucker (9) pp. 428, 433, L. L. Root (4) pp. 146, 149. **2**, Carrying nickel on the Jennings property near Hirz Mountain (N. R.).

Sierra County: **1**, It occurred with chalcopyrite at the Lost Cabin prospect (N. R.).

Siskiyou County: **1**, It is prominent with chalcopyrite at Callahan, Aubury (1) p. 105. **2**, It is said to be nickeliferous at the Hummer mine, ibid. **3**, Pyrrhotite with chalcopyrite occurs at the Bonanza mine, near Honolulu (N. R.). **4**, At the Carlson mine, Dutch Creek (N. R.). **5**, With galena in quartz at the Siskiyou mine, at the head of White Gulch (N. R.).

Trinity County: **1**, A large mass of pyrrhotite associated with chalcopyrite occurs at Island Mountain on the South Fork of Eel River, Landon (1) p. 279.

Tulare County: **1**, Pyrrhotite occurs in some of the contact deposits near Mineral King, Tucker (3) pp. 910, 917.

Tuolumne County: **1**, Pyrrhotite occurs in gneiss on the North Fork of Beaver River, Turner (22) p. 344. **2**, It occurs with sphalerite and galena at the Soulsby mine, Irelan (5) p. 744, Storms (17) p. 873. **3**, With galena and sphalerite in quartz at the Montgomery, Cherokee, Carlotta, Densmore, Draper, and Louisiana mines, Tucker (1) p. 138. **4**, It is found on the north bank of the Tuolumne River just east of Jawbone Creek, Mining and Scientific Press (36), p. 974.

Ventura County: **1**, Pyrrhotite occurs with nickel minerals and chalcopyrite at the Ventura mine (T. 1 N., R. 18 W., S. B.), Tucker and Sampson (20) p. 258.

QUARTZ

Silicon dioxide, SiO_2

Hexagonal-rhombohedral. Hexagonal prisms with pyramids very common and sometimes large. Compact and granular massive. Prominent conchoidal fracture. Brittle. Vitreous luster. Colorless, white, yellow, red, brown, green, blue, black. Streak white. H. = 7. G. = 2.65.

Infusible, and insoluble in nitric or hydrochloric acids. Soluble in hydrofluoric acid. Fused well with a flux of sodium carbonate, the fusion dissolved in water and hydrochloric acid, when evaporated to dryness, will leave the silica as an insoluble residue. The hydrochloric-acid solution, after all silicon is removed, will give no precipitates of aluminum, calcium, or magnesium when treated successively with ammonia, ammonium oxalate, and sodium phosphate, proving the mineral to be silica and not a silicate.

Common quartz is an essential constituent of granites, granodiorites, quartz porphyries, rhyolites, gneisses, schists, quartzites, and sandstones, and is an accessory mineral in many other kinds of rock, either volcanic, metamorphic, or sedimentary. Veins, ledges, seams, and pockety masses of white quartz are common in volcanic and metamorphic rocks. *Rock crystal* is a clear colorless variety which is found as hexagonal crystals. *Amethyst* is a violet-colored variety sometimes used as a gem. It occurs in groups of crystals; rarely massive. Very little good amethyst has been found in the state. *Rose quartz* is a massive pink variety. *Smoky quartz* or *cairngorm stone* is a hair-brown transparent variety occurring as crystals. The color is readily discharged or converted to citrine yellow by heat. This is a common variety of quartz and some excellent large crystals have been found in the state. *Thetis hairstone* is rock crystal containing long hair-like fibers of asbestos or actinolite. *Phantom crystals* show the outlines of one crystal within another; they are caused by inclusions of green chloritic matter or brownish earthy material arranged about the boundaries of the crystal during growth.

Inclusions of other minerals in quartz are common and have several varietal names.

Alameda County: **1**, Yellow crystals of quartz occur with glassy albite at the Newman mine on Cedar Mountain, 12 miles southeast of Livermore, Symons (3) p. 41.

Alpine County: **1**, Rose quartz has been found in Hope Valley, S. M. B. (3706).

Amador County: **1**, Fine large specimens of rock crystal, many of them rounded stream boulders, have come from Volcano and Oleta, Durrell (p. c., '45). **2**, This section has also produced good specimens of amethyst, Symons (3) p. 41, smoky, ibid., and rose quartz. **3**, Quartz carrying carbonaceous inclusions comes from the New York mine (sec. 6, T. 5 N., R. 11 E., M. D.), Preston (4) p. 140. 4, Thetis hairstone has been found at Oleta (N.R.). 5, Durrell (p.c.) has reported the occurrence of quartz crystals near Fiddletown, Carlson & Clark (2) p. 214.

Butte County: **1**, Smoky quartz occurs on the North Fork of the Feather River (N. R.). **2**, Fine rose quartz occurs near Forbestown, Sterrett (10) p. 324.

Calaveras County: **1**, Good rock crystal in fine large aggregates has been found in many of the gold mines. Mokelumne Hill, Green Mountain gravel mine near Murphy, Angels Camp, and Westpoint have produced large crystals, Storms (9) p. 124, F. L. Ransome (9) p. 11, G. E. Bailey (2) p. 468, Kunz (24) p. 65. Kunz (13) p. 587 reports the quartz as enormous clusters of crystals in gravels, and cites a 5-inch flawless sphere cut from the quartz, and one flawed sphere 7½ inches. **2**, Quartz colored green by pyroxene inclusions has been found on Garnet Hill, Moore Creek, Turner (12) p. 706.

El Dorado County: **1**, The best rock crystal, phantom crystals, and smoky quartz in the state have come from near Placerville, Hanks (12) p. 65, Kunz (5) p. 329, (6) p. 395, (8) p. 547. **2**, A blue variety of quartz occurring in pegmatite in this county has been named "el doradoite" by Watkins (1) p. 26. 3, In good clear crystals from the Josephine mine, near Volcanoville, Hanks (1) p. 361.

Inyo County: **1**, Good rock crystal and smoky quartz have been found in the Cerro Gordo district, S. M. B. (11137). **2**, Crystal Hill, in Deep Springs Valley, has supplied many good specimens of quartz crystals, Webb (p. c., '45).

Kern County: **1**, Rose quartz has been reported north of Kernville, Sterrett (4) p. 837. **2**, Large smoky quartz crystals occur in pegmatite on Black Mountain (S½ sec. 22, T. 25 S., R. 32 E., M. D.), Durrell (p. c., '45). **3**, Quartz crystals up to 10 pounds, some colored greenish by epidote inclusions are found at the Aldridge (Zelner) mine (NW¼ sec. 27, T. 25 S., R. 32 E., M. D.), Durrell (p. c., '45).

Lake County: **1**, Quartz inclusions in basalt near Clearlake Highlands have been called "Clear Lake diamonds," Hanks (15) p. 125, C. A. Anderson (9) p. 635. These are the material called "hyalite" in earlier editions of this Bulletin. **2**, Amethystine quartz has been mined for gems near Howard Springs (secs. 10, 20, 21 T. 12 N., R. 7 W., M. D.), Averill (2) p. 342, Symons (3) p. 41. The amythestine quartz is purple cordierite, Brice (1) p. 62.

Los Angeles County: **1**, Thetis hairstone has been found near Los Angeles (N. R.). **2**, Pseudomorphs of quartz after fluorite have been found in sandstone and breccia near Encino and near the head of

Higgins Canyon, on the northern slope of the Santa Monica Mountains, Murdoch (2) p. 18. **3**, Good bipyramids of quartz in basalt are abundant over the tunnel east of the Griffith Observatory, Webb (p. c., '45). **4**, Quartz showing a strong blue color occurs in graphic granite in Pacoima Canyon (NE$\frac{1}{4}$ sec. 6, T. 3 N., R. 13 W., S. B.), Neuerburg (p.c. '49).

Mariposa County: **1**, Fine rock crystal occurs at Mount Bullion, (N. R.). **2**, A. F. Rogers (41) p. 327 has described the occurrence of a large mass of quartz showing prominent parting, at White Rock on the Helm Ranch, about 25 miles east of Merced. See also R. J. Sampson and Tucker (4) p. 439.

Mono County: **1**, Rock crystal, amethyst, and tabular drusy quartz (pseudomorphs after feldspar) have come from the Bodie district, Kunz (24) p. 67, R. G. Brown (1) p. 344, Turner (30) p. 795. **2**, Quartz crystals up to 3 inches in diameter, with bubbles and cavities, occur abundantly half a mile southwest of the west end of Parker Lake, Durrell (p. c., '44).

Napa County: **1**, Fine groups of crystals came from the Silverado mine, L. L. Palmer (1) p. 29. **2**, Quartz pseudomorphs after barite, colored red with cinnabar were found at the Redington mine, Durand (1) p. 211.

Placer County: **1**, Quartz crystals, many with inclusions of green chlorite, and phantoms, occur at Shady Run, Durrell (p. c., '44).

Plumas County: **1**, Deep-colored rose quartz has come from Meadow Valley, (N. R.). **2**, Veins of blue quartz in serpentine are found southeast of Meadow Valley, Turner (11) p. 388.

Riverside County: **1**, Rock crystal, smoky quartz, and pink quartz are associated with the gem tourmaline at Coahuila, Kunz (14) pp. 66, 70. **2**, Quartz, much of it showing asterism, is obtained from a pegmatite at the Southern Pacific silica quarry near Nuevo, Wahlstrom (1) p. 694. **3**, Smoky quartz occurs in a pegmatite near Tripp Flats (sec. 2, T. 7 S., R. 2 E., S. B.), Durrell (p. c., '44).

Sacramento County: **1**, Rock crystal of fine quality is found at Folsom, S. M. B. (18996).

San Benito County: **1**, Amethyst crystals of fair color were found in vugs in the San Carlos mine of the New Idria Quicksilver Company, Symons (3) p. 41.

San Bernardino County: **1**, Quartz with rutile needles has been found in the San Bernardino Range, Kunz (16) p. 763, (24) p. 70. **2**, It is found as pseudomorphs after calcite at Hart, A. F. Rogers (3) p. 19. **3**, It occurs with specular hematite, and with chlorite phantoms in the San Bernardino Mountains about 30 miles northeast of San Bernardino, Kunz (16) p. 763. **4**, It has been found pseudomorphous after glauberite at Searles Lake, Frondel (1) p. 420. **5**, Milky white quartz showing a strong lamellar cleavage (?) occurred in an outcrop about 5 miles south of Twentynine Palms, on the road to White Tanks, Murdoch and Webb (6) p. 354. **6**, Quartz pseudomorphs after natrolite, from 3 miles north of Calico, are represented by S. M. B. (21313).

San Diego County: **1**, Rock crystal, smoky quartz, and pink quartz are associated with the green and pink tourmaline of the county. Large groups of crystals of a deep-rose color occur in the pegmatite veins which carry the tourmaline at Pala, G. A. Waring (2) p. 362. **2**, Mesa Grande, and **3**, Rincon, Kunz (24) p. 661. Rock crystal with long and

almost black needles of tourmaline occurs at Pala; crystals from Pala and Rincon show complex forms, G. A. Waring (2) p. 362. Smoky and ordinary quartz from Rincon have been spectroscopically examined by Kennard (3) p. 393. **4,** An opalescent rose quartz occurs at Escondido, Kunz (24) p. 68. **5,** Some large crystals or rolled cobbles of quartz have been found on the Santa Margarita Ranch, Kunz (2) p. 749. **6,** A large mass of rose quartz is found near the Mexican border, 29 miles from Tia Juana on the public road from San Diego to Ensenada, Kunz (24) p. 68.

San Francisco County: **1,** Quartz pseudomorphs after apophyllite have been found with datolite and pectolite at Fort Point, San Francisco, Schaller (3) p. 194, (8) p. 121, E. H. Bailey (3) p. 566.

Santa Clara County: **1,** A. F. Rogers (30) p. 81, (33) p. 316, has described paramorphs of quartz after tridymite in rhyolite at Lone Hill, near Los Gatos.

Shasta County: **1,** Diller in 1883 collected bipyramids of quartz showing the rare basal plane in granite porphyry at Salt Creek, 26 miles north of Redding, Foshag (p. c., '36).

Sierra County: **1,** A few large clear yellow quartz crystals have been found in a pegmatite at Crystal Peak, on the west side of Dog Valley, 5 miles west of Verdi, Nevada, Symons (3) p. 41.

Sonoma County: **1,** Radial spherulitic quartz is found in Alexander Valley, Symons (p. c., '46). **2,** Small clear pseudo-cubic crystals occur 3 miles north by east from Cloverdale, Vonsen (p. c., '45).

Tulare County: **1,** Rock crystal occurs at Three Rivers and in Drum Valley, Kunz (24) p. 66. **2,** Rose quartz is found at Bull Run Meadows, S. M. B. (7345). **3,** At Yokohl, Kunz (24) p. 68. **4,** Quartz with inclusions of hornblende is found at Deer Creek (N. R.). **5,** Beautiful rose quartz occurs at the Summer Rose quartz claim, 8 miles southeast of California Hot Springs near the Kern County line, Tucker (3) p. 910. **6,** Rose quartz occurs on the west side of Bull Run Ridge, near Badger, Melhase (p. c., diary). **7,** In pegmatite on ridge west of Dry Creek, about 5 miles north of Lemon Cove, Stoddard (1) p. 178. **8,** Rose quartz occurs in a pegmatite with massive black allanite on the Gasenberger Ranch near Exeter, (N. R.). **9,** Rose quartz occurs on the west side of Tobias Mountain, Symons (3) p. 41.

CHALCEDONY

Silicon dioxide, SiO_2

Cryptocrystalline. Waxy luster. Translucent to opaque. White, gray, blue, brown, black. H. = 7. G. = 2.6.

Reactions the same as for quartz.

Many names are given to the varieties of cryptocrystalline quartz that may be classed under chalcedony, most of them based on color and structure. They include *chalcedony, agate, carnelian, sard, prase, heliotrope* or *bloodstone, chrysoprase, onyx, sardonyx, jasper,* and *flint,* all of which are found in the state. Ordinary petrified wood is largely agate or chalcedony.

Myrickite is a local name applied to chalcedony having blood-red spots and patches of cinnabar.

Kinradite is a local name given to a spherulitic jasper.

Chalcedony occurs in dense masses and layers, often banded. Many large masses of chalcedony and jasper have been deposited by springs. Chalcedony is a common secondary filling of cavities and fissures in volcanic rock, and may form large geodes in this way.

It would be impossible to list all occurrences of chalcedony in the state. The following is a selection of the more interesting or unusual.

Amador County: **1**, Chrysoprase is reported in serpentine at the Mooney claims 6 miles southeast of Ione, L. L. Root (5) p. 149 (sec. 34, T. 6 N., R. 10 E., M. D.), Carlson and Clark (2) p. 11. **2**, Bluish chalcedony occurs at Volcano, S. M. B. (813).

Butte County: **1**, Chrysoprase is reported near Magalia, Engineering and Mining Journal (13) p. 653.

Calaveras County: **1**, Moss agate was found at Stockton Hill, Mining and Scientific Press (7) p. 146.

Fresno County: **1**, Large masses of white, delicately veined chalcedony are found at Panoche, W. P. Blake (9) p. 9.

Inyo County: **1**, Pebbles of red jasper and bloodstone are found at the south end of Death Valley, on the road between Shoshone and Ashford Mill, on the west slope of Jubilee Pass, Wolff (p. c., '35), Symons (3) p. 41.

Kern County: **1**, Sapphirine chalcedony was reported near Kane (Koehn, or Desert) Springs, probably in the hills to the north, Kunz (24) p. 73. **2**, Petrified wood is common in Last Chance Canyon, Murdoch (p. c., '45). **3**, Semi-opal and variegated chalcedony are found near Rademacher, about 14 miles east of Freeman Post Office, Kunz (14) p. 454. **4**, Excellent jasper and petrified wood occur on Gem Hill (sec. 18, T. 10 N., R. 12 W., S. B.), Lewis (4) p. 116.

Los Angeles County: **1**, The so-called moonstones found at Redondo Beach are chalcedony, Kunz (17) p. 755.

Marin County: **1**, A spherulitic jasper, "kinradite" has been found 1 mile south of Sausalito, Sterrett (6) p. 870.

Modoc County: **1**, Abundant and varied agates occur on the shore of the south end of Goose Lake, according to J. A. Edman, Sterrett (4) p. 807.

Monterey County: **1**, Brecciated jasper occurs in Stone Canyon, Nelson Creek, Symons (p. c., '46).

Napa County: **1**, Petrified wood is abundant near Calistoga, Goodyear (4) p. 356.

Placer County: **1**, Fine geodal masses of chalcedony have been found at the Spanish mine, Ophir district, (N. R.).

Plumas County: **1**, Chrysoprase occurs in the gravels at Meadow Valley, Kunz (17) p. 755.

San Benito County: **1**, Bluish-gray chalcedony occurred as pseudomorphs after barite crystals in the Phipps quicksilver mine east of Emmett, (N. R.).

San Bernardino County: **1**, Large masses of moss agate have been collected in the San Bernardino Mountains, Kunz (16) p. 763. **2**, Geodes of fine blue chalcedony occur 2 miles northeast of Leadpipe Springs (approx. T. 29 S., R. 45 E., M. D.), Sterrett (9) p. 650, Melhase (3) No. 7, p. 8. **3**, Agate with bright-red inclusions of cinnabar (myrickite) is found about 15 miles northeast of Leadpipe Springs, Sterrett (9) p. 651. **4**, Myrickite also occurs 15 miles east of Indian Springs, (sec. 4, T. 30 S., R. 46 E., M. D.), Sterrett (9) p. 651. **5**, Chalcedony pseudomorphs after calcite come from the Barium Queen mine, near Lead Mountain, Durrell (p. c., '45). **6**, Very perfect pseudomorphs after barite come from the Mud Hills (sec. 20, T. 11 N., R. 1 W., S. B.),

Durrell (p. c., '45). 7, Some bloodstone is reported from Brown Mountain, just south of Wingate Pass, Sterrett (8) p. 1050. 8, Red and green jasper, in part bloodstone, is reported from Canyon Springs, Sterrett (6) p. 872.

San Diego County: 1, Red, yellow, and gray chalcedony from southeast of Dulzura is said to polish beautifully, Kunz (26) p. 1346. 2, The amethystine chalcedony found "east of San Diego" has been called violite (N. R.).

San Francisco County: 1, Kinradite is found near Land's End Station, 1 mile northeast of the Cliff House, San Francisco, Kunz (24) p. 75, Sterrett (6) p. 870.

San Luis Obispo County: 1, Myrickite, chalcedony colored by particles of cinnabar, has come from the Rinconada mine, S. M. B. (18838).

San Mateo County: 1, Hollow chalcedony goedes with liquid and a moving bubble have been found in the beach gravels at Pescadero, Kunz (24) p. 71.

Santa Clara County: 1, Decorative orbicular jasper comes from Paradise Valley near Morgan Hill, Melhase (3) No. 7, p. 7, The Mineralogist (1) p. 34. 2, Myrickite is reported from Coyote, S. M. B. (18832).

Siskiyou County: 1, Bloodstone is found at Bogus Mountain, 18 miles northeast of Yreka, Symons (3) p. 41.

Sonoma County: 1, At the Petrified Forest west of Calistoga, the petrified wood is largely chalcedony (N. R.).

Tulare County: Chrysoprase has been mined at several localities in the county: 1 mile east of Lindsay; Venice Hill; near Visalia (T. 18 S., R. 26 E., M. D.); Stokes Mountain (secs. 9, 10, T. 16 S., R. 26 E., M. D.); Deer Creek (sec. 20, T. 22 S., R. 28 E., M. D.), Kunz (13) p. 589, (24) pp. 12, 74; Tucker (3) p. 911.

QUICKSILVER

See mercury

RASORITE

See kernite

REALGAR

Arsenic monosulphide, AsS

Monoclinic. Crystals short prismatic, striated vertically; also granular massive and incrustations. Sectile. Resinous luster. Color bright red to orange yellow. Streak orange yellow. H. = 1½-2. G. = 3.56.

Heated on charcoal, it gives volatile white fumes of arsenic oxide having a garlic odor. Soluble in caustic alkalies.

Alpine County: 1, Deep-red realgar coating pyrite, with minute white octahedrons of arsenolite, occurred in the Monitor mine, Hanks (12) p. 344.

Imperial County: 1, Kelley (1) p. 137 has reported the occurrence of realgar with sulphur and claudetite at a sulphur prospect 6 miles north of the 4S Ranch and 1½ miles west of the Colorado River.

Inyo County: 1, Realgar has been found in the Cerro Gordo district, Loew (2) p. 186.

Kern County: 1, A small amount of realgar occurs with borax and kernite in the borate mines of the Kramer district, Schaller (45) p. 165.

Los Angeles County: **1**, Very thin films and crystals of realgar appear on fracture surfaces in massive colemanite from the Sterling borax mine, Tick Canyon, H. Stager (p.c. '47).

San Bernardino County: **1**, Small crystals of realgar have been found with hanksite, pirssonite, and halite in the salt beds of Searles Lake. **2**, Weeks (2) p. 763, has reported that realgar occurs in the mines of the Calico district. **3**, It has been reported 40 miles from the Needles, E. S. Dana (5) p. 1097, S. M. B. (10338).

Siskiyou County: **1**, Realgar has come from Scott Bar, Klamath River, W. W. Bradley (29) p. 311.

Sonoma County: **1**, Realgar occurs in small prismatic crystals with metacinnabar and curtisite in the cracks and interstices of sandstone at Skaggs Springs (T. 10 N., R. 11 W., M. D.), F. E. Wright and Allen (3) p. 169, A. L. Ransome and Kellog (1) p. 469, Everhart (4) p. 390.

Trinity County: **1**, Realgar has been reported from Deadwood (T. 33 N., R. 8 W., M. D.), Bixby (2) p. 169. **2**, Specimen, S. M. B. (11391) came from the northwestern part of the county.

RED COPPER ORE

See cuprite

* REDINGTONITE, 1890

Hydrous chromium, nickel, aluminum, iron, and magnesium sulphate
$(Fe,Mg,Ni)(Cr,Al)_2(SO_4)_4 \cdot 22H_2O(?)$

Finely fibrous to granular massive. Silky luster, color pale purple. G. = 1.76.

Reactions are similar to those for knoxvillite.

This mineral may be a chromiam member of the halotrichite group.

Napa County: **1**, Redingtonite is a pale-purple sulphate which was mixed with the knoxvillite from the Redington mine at Knoxville. First discovered by Becker (4) p. 279, it was described as a new mineral by Melville and Lindgren (1) p. 23. It was also noted by W. W. Bradley (5) p. 83.

Analysis

SO_3	Al_2O_3	Cr_2O_3	Fe_2O_3	FeO	NiO	MnO	MgO	H_2O at 100°	H_2O ab. 100°	Insol.
35.35	5.14	7.51	0.19	4.58	1.00	tr.	1.85	27.09	14.34	3.46 = 100.51%

RED LEAD

See minium

RED OCHER

See hematite

REDRUTHITE

See chalcocite

RESIN OPAL

See opal

RHODOCHROME

See penninite

RHODOCHROSITE

Manganese carbonate, $MnCo_3$

Hexagonal-rhombohedral. Small crystals and massive. Cleavage perfect rhombohedral. Brittle. Vitreous luster. Color rose red or gray. Streak white. H. = 3½-4½. G. = 3.45-3.60.

Its effervescence with acid, and wine-colored or amethystine bead with borax serve to distinguish it.

Rhodochrosite is one of the important primary minerals in deposits of manganese ores, and is typical of those of the Franciscan type, which occur in the Coast Ranges.

Alameda County: **1**, Rhodochrosite, both gray and pink occurs commonly in the manganese mines of the Tesla district, southeast of Livermore, W. W. Bradley et al. (4) p. 24. **2**, It occurs with oxides on the Arroyo Mocho road (NW¼ sec. 9, T. 4 S., R. 3 E., M. D.), ibid. p. 26.

Alpine County: **1**, Pink crystals of rhodochrosite were found in the Colorado mine No. 2, Monitor district, Hanks (12) p. 159, Irelan (1) p. 105, Eakle (16) p. 25, Gianella (1) p. 342. **2**, It is also found in other mines in the district, Mining and Scientific Press, (9) p. 151, Logan (4) p. 401, Partridge (1) p. 264.

Amador County: **1**, It occurs in several mines (sec. 10, T. 7 N., R 11 E., M. D.), P. D. Trask et al. (4) pp. 102, 103.

Calaveras County: **1**, It occurs with bementite at the Big Little Bear and Kellog (sec. 24 T. 3 N., R. 11 E., M. D.), P. D. Trask et al. (4) p. 60.

Humboldt County: **1**, Rhodochrosite occurs with bementite at Charles Mountain (sec. 2, T. 1 S., R. 4 E., H.), P. D. Trask et al. (4) p. 77

Madera County: **1**, It occurs in a replacement deposit with rhodonite and specular hematite at Agnew Meadows (T. 3 S., R. 26 E., M. D.), P. D. Trask et al. (4) p. 79.

Mariposa County: **1**, Rhodochrosite occurs with rhodonite and spessartite at the Surprise claim (sec. 23, T. 3 S., R. 17 E., M. D.), P. D. Trask et al. (4) p. 132. **2**, Gray and red rhodochrosite are associated with psilomelane in Indian Gulch, (N. R.).

Mendocino County: **1**, Rhodochrosite occurs in the Mount Sanhedrin group at Impassible Rock (sec. 30, T. 20 N., R. 11 W., M. D.), W. W. Bradley et al. (4), P. D. Trask et al. (4) p. 136. **2**, Cinco de Mayo (sec. 27, T. 24 N., R. 11 W., M. D.), ibid. (1) p. 134. **3**, Thomas (sec. 22, T. 17 N., R. 12 W., M. D.), ibid., p. 141. **4**, Brereton (sec. 31, T. 23 N., R. 11 W., M. D.), Taliaferro and Hudson (3) p. 238.

Placer County: **1**, Small druses of rhodochrosite have been found in some of the mines of the county, (N. R.).

San Bernardino County: **1**, It occurs at the New York mine near Manvel, (N. R.). **2**, It has been reported as a vein mineral in quartz at the Sagamore mine, New York Mountains, Cloudman et al. (1) p. 790.

San Joaquin County: **1**, It occurs in the Ladd mine at Corral Hollow, W. W. Bradley et al. (4) p. 65, P. D. Trask et al. (4) p. 86.

Santa Clara County: **1**, Rhodochrosite occurred as pink crystals showing unusual faces in the manganese boulder near Alum Rock Park, 5 miles east of San Jose, A. F. Rogers (21) p. 446. **2**, It is found in the Jones group, (sec. 27, T. 6 S., R. 5 E., M. D.), P. D. Trask et al. (4) p. 87. **3**, From manganese property on the Miller Ranch, on the Sierra Road on the extreme southeast point of Los Buellis Hills, Crittenden (1) p. 64.

Siskiyou County: **1,** It occurs in quartzite at the Oro Fino No. 2 (sec. 17, T. 43 N., R. 9 W., M. D.), P. D. Trask et al. (4) p. 60.

Sonoma County: **1,** Massive gray rhodochrosite occurs with bementite at the Aho property (sec. 15, T. 8 N., R. 12 W., M. D.), 6 miles west of Cazadero, P. D. Trask et al. (4) p. 89.

Stanislaus County: **1,** It was found with calcite and pyrolusite in the Buckeye manganese mine, Hospital Creek, Laizure (3) p. 213, Taliaferro and Hudson (3) p. 239.

Tuolumne County: **1,** Rhodochrosite occurs with bementite at the Hughes mine (sec. 17, T. 2 S., R. 15 E., M.D.) P. D. Trask et al. (4) p. 91.

Trinity County: There are at least a dozen localities at which manganese ores, carrying more or less rhodochrosite with bementite and oxides, are found in the southern half of the county. The detail of these localities is given by P. D. Trask et al. (4) pp. 194-206; the names of the properties are: Armstrong; Bertha; Blue Jay; Dahrman; Emma; Hale Creek; Lucky Bill; Manganese Queen; Rainy Day; Shell View; Spider. W. W. Bradley et al. (4) pp. 89-91 describe some of these also.

RHODONITE

Manganese silicate, $MnSiO_3$

Triclinic. Crystals tabular, often large. Generally massive or in grains. Cleavage perfect prismatic. Vitreous luster. Color rose pink. Streak white. H. = 5½-6½. G. = 3.4-3.68.

Fusible. Gives a violet or wine-colored bead with borax. Slightly acted upon by acids.

Rhodonite is one of the important primary minerals of manganese ores, and is typical of strongly metamorphosed areas, such as those in the deposits on the west side of the Sierra Nevada.

Alameda County: **1,** It occurs in the Corral Hollow manganese deposits, Wilke (p. c., '36).

Amador County: **1,** Rhodonite is present in several of the manganese deposits of the county: Alexander; Custer; Du Frene; Everett; Jones; Perini; Peyton; Stirnaman. The exact locations are given by P. D. Trask et al. (4) pp. 102, 103.

Butte County: **1,** It occurs in several deposits in T. 20 N., R. 7 E., M. D., P. D. Trask et al. (4) pp. 104, 105.

Calaveras County: **1,** Rhodonite is found in the following deposits: Airola; Callahan; Daniels; Gorham; Harrington; Hauselt; Pescia; P. D. Trask et al. (4) pp. 106, 107.

El Dorado County: **1,** Rhodonite occurs in the Martinez gold claim (sec. 13, T. 9 N., R. 10 E., M. D.), P. D. Trask et al. (4) p. 111.

Fresno County: **1,** It occurs in the Crisle, Harper, McMurtry, Price, Trewick, and Woods claims, P. D. Trask et al. (4) p. 112.

Humboldt County: **1,** Rhodonite is found in the Sam Brown claim (sec. 15, T. 8 N., R. 4 E., H.), P. D. Trask et al. (4) p. 116. **2,** At the Woods (Charles Mountain) manganese claim (sec. 2, T. 2 S., R. 4 E., H.), S. M. B. (18766).

Kern County: **1,** Rhodonite in large crystals was found at the O. K. mine (sec. 27?, T. 26 S., R. 34 E., M. D.), P. D. Trask et al. (4) p. 123 **2,** Other occurrences in the county include the Big Indian, Culbert Manganese Queen, and Midlothian, ibid. pp. 123, 124.

Los Angeles County: **1**, Massive deep-pink rhodonite occurs on Portal Ridge, near Lancaster. Several deposits are found here (T. 5, 6 N., R. 12, 13, 14 W., S. B.), P. D. Trask et al. (4) p. 128.

Madera County: **1**, It occurs with rhodochrosite, pyrolusite, manganite, and psilomelane near Coarse Gold, P. D. Trask et al. (4) p. 130. **2**, It occurs with garnet and epidote in crystalline limestone on the south side of Shadow Creek Canyon in the Ritter Range, Erwin (1) p. 67, Goudey (1) p. 26. **3**, On the Garnet Lake side of Shadow-Garnet divide, ibid. p. 26. **4**, At the Agnew Meadows deposit, P. D. Trask et al. (4) p. 63.

Monterey County: **1**, Beach boulders of gem-quality rhodonite have been found at Lime Kiln Creek, Crippen (p.c. '51).

Mariposa County: **1**, Rhodonite is found at the Donnelly, Robie, and Surprise properties, P. D. Trask et al. (4) p. 132.

Nevada County: **1**, P. D. Trask et al. (4) pp. 147, 148, locate 15 occurrences of rhodonite in the county. Averill (13) p. 141, notes one of these (Manga-Chrome or Stearns & Owens).

Placer County: **1**, Several rhodonite deposits are in the vicinity of Forest Hill, P. D. Trask et al. (4) p. 149.

Plumas County: **1**, Good red rhodonite has come from Genesee Valley (T. 25, 26 N., R. 11 E., M. D.), P. D. Trask et al. (4) p. 153. **2**, Rare but good material occurred with copper at the Diadem lode, Meadow Valley, Turner (12) p. 590, (9) p. 6. **3**, Good gem rhodonite has been reported to occur near Taylorsville, Sterrett (4) p. 837. **4**, Several other localities are listed by P. D. Trask et al. (4) pp. 151-153. These include the Benner, Burch and Woody, Cannon, Crystal Lake, Dickie Bird, Iron Queen, Liberty, Lost Soldier, Rush Creek, Sunset, and Valley View.

Riverside County: **1**, It was found with pyrolusite and psilomelane near Elsinore (secs. 23, 24, T. 5 S., R. 4 W., S. B.), W. W. Bradley et al. (4) p. 58.

San Bernardino County: **1**, Minor amounts of rhodonite have been found near Colton, Hanks (12) pp. 316, 345, Mining and Scientific Press, (22) p. 152. **2**, In pebbles at the summit of Cajon Pass, Murdoch and Webb (11) p. 552.

San Diego County: **1**, Beautiful specimens of rhodonite have come from the Anza State Park, near the Riverside County line, Tucker and Reed (26) p. 29. **2**, The Ruby deposit (sec. 16, T. 18 S., R. 8 E., S. B.), has rhodonite with spessartite, P. D. Trask et al. (4) p. 85. **3**, Occurs with manganese oxides near Jacumba, Berkholz (16), p. 26.

Shasta County: **1**, Rhodonite-bearing deposits are found in Goat Camp, Nigger Hill, and Victor claims, P. D. Trask et al. (4) p. 182.

Siskiyou County: **1**, Excellent rhodonite occurs at Sawyers Bar, S. M. B. (15180). **2**, Rhodonite partly altered to manganese oxides occurs near Gazelle. **3**, On the South Fork of Salmon River. **4**, Specimens of rhodonite have come from Empire Creek. **5**, Also Dutch Creek, near Gottville. **6**, Massive red rhodonite occurs on Indian Creek, near Happy Camp, W. W. Bradley (23) p. 217. Specific references for the above are in general lacking. Many other occurrences are listed by P. D. Trask et al. (4) pp. 183-185.

Trinity County: **1**, Rhodonite occurs with rhodochrosite at the Manganese Queen claim (sec. 26, T. 30 N., R. 12 W., M. D.), P. D. Trask

et al. (4) p. 200. **2**, It also occurs at the Shell View (sec. 16, T. 4 S., R. 6 E., H.), ibid. p. 202, aud **3**, Spider (sec. 20, T. 28 N., R. 11 W., M. D.), ibid. p. 203.

Tulare County: **1**, Coarse, massive rhodonite occurs as a contact metamorphic mineral near Lemon Cove (secs. 22, 34, T. 16 S., R. 27 E., M. D.), Tucker (3) p. 911, Sterrett (7) p. 1063. **2**, Occasional layers of rhodonite, formed by metamorphism of manganiferous cherts are found near Greasy Creek and on the west side of Dry Creek, Durrell (2) p. 32.

Tuolumne County: **1**, It was found with pyrolusite on Rose Creek near Columbia, P. D. Trask et al. (4) p. 207. **2**, It occurs as veins altering to manganese oxides 2 miles north of Sonora, Hanks (12) p. 345, W. W. Bradley et al. (4) p. 91. Another half-dozen occurrences are listed (Flaming Arrow, Hog Mountain, Hughes, Pedro, West, Wonder) by P. D. Trask et al. (4) pp. 207, 208.

Yuba County: **1**, Rhodonite occurs in the Clemens claim (sec. 29, T. 19 N., R. 7 E., M. D.), P. D. Trask et al. (4) p. 208.

RIEBECKITE

See amphibole, soda amphibole

† RIVERSIDEITE, 1917

See tobermorite

ROCK CRYSTAL

See quartz

ROCK SALT

See halite

RÖMERITE

Hydrous iron sulphate, $FeO \cdot Fe_2O_3 \cdot 4SO_3 \cdot 14H_2O$

Triclinic. In tabular crystals; granular, massive. One perfect cleavage. Brittle. Color chestnut brown. H. = 3-3½. G. = 2-15.

Fusible. Becomes magnetic on heating. Easily soluble in water. Taste saline, astringent.

Alpine County: **1**, Römerite occurs as brittle chestnut-brown crystals in masses and on stalactites of melanterite, at the Leviathan sulphur mine, 7 miles east of Markleeville, Gary (1) p. 489, Nichols (1) p. 172.

Contra Costa County: **1**, A little römerite has been found in the Mount Diablo mine (SE¼ sec. 29, T. 1 N., R. 1 E., M. D.), C. P. Ross (2) p. 42.

San Bernardino County: **1**, Römerite occurs with alunite, coquimbite, krausite, and other sulphates in the Calico Hills near Borate, about 6 miles northeast of Yermo, Foshag (19) p. 352.

Trinity County: **1**, Small brown crystals of römerite showing complex forms occurring on altered pyrrhotite from Island Mountain were described by Landon (1) p. 279.

* ROSCOELITE—Vanadium Mica, 1875

Hydrous potassium, aluminum, and vanadium silicate, $H_2K(Al,V_3)(SiO_4)_3$

Monoclinic. In minute scales, often in stellate groups. Cleavage perfect basal. Pearly luster. Color clove brown to greenish brown, and dark green. H. = 2½. G. = 2.97.

Similar to biotite in its reactions, but in addition gives a green bead of vanadium with phosphorous salt.

Vanadium is a rare constituent of some igneous rocks, and is occasionally found in small amounts in biotite. Roscoelite is unique in having a large percentage of vanadium in place of iron, thus forming a vanadium-mica.

El Dorado County: **1**, Layers of a dark-green micaceous mineral, up to half an inch in thickness, interlaminated with gold, found at the Stuckslager or Sam Sims mine (sec. 24, T. 11 N., R. 9 E., M. D.) on Granite Creek, near Coloma, proved to be a new mineral which was named roscoelite by J. Blake (2) p. 31. It was later described and analyzed by Genth (7) p. 32, Roscoe (1) p. 110 and Hillebrand et al. (2) p. 456, Hillebrand (3) p. 70.

	SiO_2	TiO_2	V_2O_3	V_2O_5	V_6O_{11}	Al_2O_3
Genth	47.69	--	--	--	22.02	14.10
Roscoe	41.25	--	--	28.60	--	14.14
Hillebrand	45.17	0.78	24.01	--	--	11.54

	Fe_2O_3	Mn_2O_3	FeO	MgO	CaO	Na_2O	K_2O	Li_2O	H_2O
Genth	--	--	1.67	2.00	tr.	0.19	7.59	tr.	4.96 = 100.22%
Roscoe	1.13	1.15	--	2.01	0.61	0.82	8.56	--	3.35 = 101.62%
Hillebrand	--	--	1.60	1.64	--	0.06	10.37	tr.	4.69 = 99.86%

2, Several hundred pounds of roscoelite were found in Big Red Ravine, near the old Sutter Mill, (sec. 31, T. 11 N., R. 10 E., M. D.), but were destroyed to obtain the interlaminated gold, Hanks (4) p. 428, (7) p. 263.

It was reported by Kimble (1) pp. 343, 344, from the surface soil at the eastern base and part of the slope of Mount Thompson, as well as in pockets. Determination of the optical properties was made by F. E. Wright (1) p. 305. **3**, An occurrence in quartz was found also in the Tip Top vein (sec. 7, T. 11 N., R. 10 E., M. D.), Hanks (12) p. 349. This is represented by a beautiful specimen, S. M. B. (5768).

Hillebrand et al. (2) pp. 457, 458, described in detail 5 occurrences of roscoelite in this locality.

Los Angeles County: **1**, It has been doubtfully reported near Los Angeles, W. W. Bradley (28) p. 498.

ROSE QUARTZ

See quartz

RUBELLITE

See tourmaline

RUBY SILVER

See pyrargyrite or proustite

RUTILE

Titanium dioxide, TiO_2

Tetragonal. Granular and subhedral. Long prisms, vertically striated, and grains; crystals often twinned. Cleavage prismatic distinct. Brittle. Adamantine to metallic luster. Color reddish brown to brownish black. Streak pale brown. H. = 6-6½. G. = 4.18-4.25.

Infusible. With phosphorous salt yields a delicate violet bead. Insoluble in acids.

Strüverite **is tantalian rutile.**

Sagenite **is rutilated quartz.**

Rutile, as a rock constituent in microscopic crystals, is common in many of the metamorphic rocks of the state. Small grains and crystals are frequently found in beach and river sands.

Alpine County: **1**, Granular and subhedral rutile occurs with lazulite and anadalusite about 10 miles south-southwest from Markleeville, W. W. Bradley (29) p. 311.

Amador County: **1**, Needles of rutile in quartz, forming sagenite, have been reported to occur at Tylers Ranch, near Oleta, (N. R.).

Butte County: **1**, Rutile was a constituent of the gold washings at Cherokee, Silliman (12) p. 133.

Contra Costa County: **1**, Irregular patches of brown rutile occur with sphene in glaucophane schist near the south end of the Berkeley Country Club, Coats (p. c., '36).

Fresno County: **1**, Brownish-red rutile crystals occur with ilmenite near Friant (N. R.). **2**, Striated prismatic crystals of rutile have been found in glaucophane schist near Panoche, Foshag (p. c., '36).

Marin County: **1**, Fair-sized prismatic crystals of rutile have been found in a boulder of glaucophane schist on the beach of the Tiburon Penninsula about 150 yards north of California Point, Vonsen (p. c., '36).

Mendocino County: **1**, Long prismatic crystals of rutile embedded in chlorite occur in glaucophane schist in a highway cut about 3½ miles north of Longvale on the new Covelo road, Vonsen (p. c., '37).

Mono County: **1**, Abundant minute specks of rutile occur in andalusite at the mine of Champion Sillimanite, Incorporated, on the western slope of the White Mountains, 7 miles east of Mocalno, Peck (1) p. 151, Kerr (3) p. 627, and crystals of rutile up to an inch in length are found on the Moreau Claim about a mile from this deposit, Kerr (3) p. 627. **2**, It occurs in small reddish-brown crystals in white quartzite with bands of blue lazulite on Green Creek one mile west of Green Lake, (sec. 28?, T. 3 N., R. 24 E., M. D.), Woodhouse (p. c., '35).

Placer County: **1**, Rutile has been reported at Michigan Bluff. (N. R.).

Riverside County: **1**, A small mass of strüverite was found at the Anita mine (sec. 22, T. 6 S., R. 1 E., S. B.), Fisher (1) p. 86.

San Benito County: **1**, Slender, doubly terminated red crystals of rutile as much as a quarter of an inch in size appear in altered serpentine, and associated with perovskite and andradite garnet half a mile south of the Gem mine, Walters (p.c. '51).

San Bernardino County: **1**, Discontinuous concentrations of rutile occur in thin beds of quartzite near the Mojave River southwest of Barstow (SE¼ SW¼ sec. 21, T. 9 N., R. 3 W., S.B.), W. H. Grant (p.c. '47).

San Diego County: **1**, Abundant minute crystals of rutile occur scattered through the quartz of the dumortierite dike near Alpine, Schaller (7) p. 211.

Santa Clara County: **1**, Rough crystals of rutile occur in glaucophane schist in the Coyote Valley about 6 miles east of Morgan Hill, The Mineralogist (4) p. 41.

SAGENITE

See rutile

* SAHAMALITE, 1954

Magnesium iron carbonate, with rare earth metals, $(Mg,Fe)(Ce,La,Nd,Pr)_2(CO_3)_4$

Monoclinic, minute tabular crystals, often showing many forms. Cleavage poor. G. = 4.3. H. not determined. Colorless.

Difficultly soluble in acids.

San Bernardino County: **1**, Minute tabular crystals, almost microscopic in size, were discovered in barite-dolomite rock in the bastnaesite deposit at Mountain Pass, Jaffe et al. (2) p. 721.

SAL AMMONIAC

Ammonium chloride, NH_4Cl

Isometric. Crystals, crusts, and efflorescences. Rather brittle. Vitreous. White, yellowish, grayish. H. = 1½-2. G. = 1.528.

Very easily volatile without fusion when heated and is wholly converted into dense white fumes. Heated in a closed tube with soda or lime, ammonia is given off and can be detected by odor. Soluble in water.

Imperial County: **1**, Sal ammoniac (?) was found as a crust in fissures near the mud volcanoes at Niland, J. L. Le Conte (1) p. 5.

Inyo County: **1**, According to G. E. Bailey (2) p. 106, sal ammoniac is found as efflorescences at some of the fissure springs in Death Valley.

Los Angeles County: **1**, A white crystalline incrustation of sal ammoniac was found in the Monterey shale of Burning Mountain (at the Bernheimer Gardens), A. F. Rogers (7) p. 373, Clearwater (1) p. 2.

Santa Barbara County: **1**, Crusts of sal ammoniac 5 millimeters thick, associated with sulphur, came from burning oil-shales on the Hope Ranch, A. F. Rogers (7) p. 373.

* SALMONSITE, 1912

Hydrous iron and manganese phosphate, $Fe_2O_3{\cdot}9MnO{\cdot}4P_2O_5{\cdot}14H_2O$

Orthorhombic. Cleavable fibrous masses. Color buff yellow. H. = 4. G. = 2.88.

Reacts similarly to vivianite, but gives in addition a blue-green bead of manganese with sodium carbonate.

San Diego County: **1**, Salmonsite is a buff-yellow alteration product of hureaulite, associated with fibrous "palaite" and blue strengite, which was discovered in the Stewart mine at Pala. It was described and analyzed by Schaller (29) p. 144, Larsen (11) p. 129.

FeO	MnO	CaO	Fe_2O_3	P_2O_5	H_2O+	H_2O-	Insol.
0.13	37.74	1.06	9.53	34.86	15.30	0.43	1.40 = 100.45%

SALTPETER

See niter

SALVADORITE

See kröhnkite

SAMARSKITE

A niobate and tantalate of the rare earths, probably AB_2O_6 with A = Y,Er,Ce,La,U,Ca,Fe,Pb,Th; B = Cb,Ta,Ti,Sn,W,Zr

Orthorhombic. Crystals square or rectangular prisms or tabular, usually rough. Massive. Brittle. H. = 5-6. G. = 5.69-6.2. Luster vitreous to resinous, or splendent. Color velvet black. Streak dark reddish brown. Transparent in thin splinters.

Riverside County: 1, Samarskite (?) has been reported from the Southern Pacific silica quarry near Nuevo, W. W. Bradley (28) p. 207. An aggregate of poorly formed crystals and grains, found associated with cyrtolite in quartz and feldspar at the Southern Pacific silica quarry near Nuevo, was named nuevite for the locality, Murdoch (19) p. 1219. The mineral has since been shown by x-ray pattern of ignited material to be samarskite, Murdoch (26) p. 358.

* SANBORNITE, 1931

Barium silicate, $Ba_2Si_4O_{10}$

Triclinic. Platy. Micaceous cleavage. Vitreous luster. Colorless to white. H. = 5. G. = 4.19.

Decomposed by hydrochloric acid, with swelling of plates.

Mariposa County: 1, Sanbornite was first found in California with celsian and gillespite in a metamorphic rock 1 mile north of Trumbull Peak, near Incline. It was described and named by A. F. Rogers (39) p. 161, (36) p. 84, W. W. Bradley (17) p. 82, with analysis by O. C. Shepard:

SiO_2	Al_2O_3	Fe_2O_3	CaO	SrO	BaO
42.2	1.5	tr.	0.1	0.2	50.4 = 94.4%

Melhase (5) p. 3 gives details of its first discovery and exact location.

SANIDINE

See feldspar, orthoclase

SAPONITE

See montmorillonite

SARD, SARDONYX

See quartz, chalcedony

SASSOLITE

Boric acid, $B(OH)_3$

Triclinic. Usually small, white, pearly scales. Perfect basal cleavage. Very easily fusible. Found as sublimates about volcanic vents, or as an efflorescence about hot springs carrying boric acid in solution.

Lake County: 1, Sassolite was found as an efflorescence around the springs at Siegler Springs, John A. Veatch (2) p. 180, G. E. Bailey (2) p. 54.

Tehama County: 1, Sassolite occurred as an efflorescence at Tuscan (Lick) Springs, G. E. Bailey (2) p. 69.

SATINSPAR

See gypsum

SAUSSURITE

See zoisite

SCAPOLITE—Wernerite

Scapolite is the name given to a group of rock-forming silicates consisting of isomorphous mixtures of marialite, $3NaAlSi_3O_8 \cdot NaCl$ and meionite, $3CaAl_2Si_2O_8 \cdot CaCO_3$

Tetragonal. Usually massive granular. Brittle. Luster vitreous to pearly. Color white, gray, or pink. Streak uncolored. H. = 5-6; marialite, G. = 2.63; meionite, G. = 2.72.

Fuses easily with slight intumescence to a white blebby glass. A yellow sodium flame is usually obtained. Marialite is only slightly attacked by acids, whereas meionite is easily decomposed.

The scapolites are in general formed by contact metamorphism.

Inyo County: **1**, Scapolite was found at the Pine Creek tungsten mine in a contact zone with idocrase and wollastonite, Hess and Larsen (1) p. 276. **2**, A specimen of scapolite with chrysocolla, S.M.B. (21326), has been received from 3 miles east of Dodd Spring, Ubehebe mining district.

Kern County: **1**, Scapolite occurs in a contact zone of a scheelite ore at Weldon, Kelso Creek, Hess and Larsen (17) p. 266.

Nevada County: **1**, Scapolite was doubtfully identified in a contact schist at Nevada City and Grass Valley, Lindgren (12) p. 91.

Riverside County: **1**, Scapolite occurs at Crestmore as white radiating aggregates of fine needles in contact rock with wollastonite and diopside, Eakle (15) p. 350, Daly (1) p. 649, and as long prisms in blue calcite, Woodford et al. (10) p. 362. **2**, It occurs as the predominant mineral in small dikes with pyroxene, apatite, and sphene, at the iron-ore deposit in the Eagle Mountains, Harder (6) p. 54. **3**, It is found also in the contact rocks of the new city quarry, south of Riverside, Richmond (1) p. 725.

Tulare County: **1**, Scapolite occurs in a metamorphic rock with wollastonite, calcite, and diopside southwest of Three Rivers (S½ sec. 25, T. 17 S., R. 28 E., M. D.), Durrell (p. c., '35).

SCAWTITE

Hydrated silicate and carbonate of calcium, $Ca_6Si_6O_{18}\cdot 2H_2O:CaCO_3$

Monoclinic. Small plates in subparallel or slightly divergent groups. Cleavage basal pinacoidal, perfect, and side pinacoidal, less perfect. H. = 4.5-5. G. = 2.77. Vitreous luster. Colorless.

Riverside County: **1**, Small tabular crystals of scawtite have been found lining veins in massive diopside-wollastonite-spurrite rock on the 910 level of the Commercial quarry at Crestmore, Murdoch (30) p. 1347.

* SCHAIRERITE, 1931

$Na_2SO_4\cdot Na(F,Cl)$

Hexagonal-rhombohedral. Minute crystals. Vitreous. Colorless. H. = 3½. G. = 2.612.

Easily fusible. Soluble in water.

San Bernardino County: Schairerite was discovered as a new mineral in drill samples from Searles Lake. The minute crystals were described by Foshag (17) p. 133.

Analysis

Ig. loss	Insol.	$(Fe,Al)_2O_3$	CaO	Na	K	SO_4	Cl	F
0.90	0.20	0.15	0.30	35.77	0.13	50.01	3.44	8.08 = 98.98%

SCHEELITE

Calcium tungstate, $CaWO_4$

Tetragonal. Pyramidal crystals and massive. Pyramidal cleavage. Vitreous luster. Color white, yellow, brown. Streak white. H. = 4½-5. G. = 5.9-6.1.

Difficult to fuse and only soluble by boiling in strong hydrochloric acid; the solution becomes bright yellow and tungstic oxide is precipitated.

On the addition of tin and boiling, the solution turns blue and later brown. Ammonia and ammonium oxalate added to the diluted hydrochloric acid solution will precipitate the calcium.

Scheelite is the principal tungsten mineral of the state, and a vast number of deposits exist, some of them rather important. A comprehensive compilation of occurrences was published in Volume 38 of the California Journal of Mines and Geology, numbers 3 and 4, 1942. Prospecting with ultraviolet light has been responsible for the discovery of many occurrences. The principal producing areas are in Inyo, Kern, and San Bernardino Counties, but smaller deposits occur in many of the others, and references will be given to these, by counties. Two general references are Jenkins (1) and Krauskopf (1), the latter covering Madera, Fresno, and Tulare counties.

Fresno County: **1**, One mile southwest of Dunlap (sec. 3, T. 14 S., R. 26 E., M.D.), Kerr (6) p. 139.

Inyo County: **1**, The most important occurrence is at the Pine Creek tungsten mine, at an elevation of 11,000 feet, where the scheelite is accompanied by considerable molybdenite, and occurs at the contact of intrusive granite and the old metamorphic rocks, Hess and Larsen (17) p. 275, Tucker (4) p. 301. **2**, Another important area is in the Tungsten Hills, northwest of Bishop, where a number of deposits occur. A. Knopf (6) pp. 238, 247, Tucker (4) pp. 302, 303, Tucker and Sampson (25) pp. 462, 466, Lemmon (5) pp. 507, 511, Bateman et al. (2) pp. 31-42. Other references are as follows: Engineering and Mining Journal (17) p. 186; A. Knopf (6) pp. 247, 248; Tucker (4) p. 301; Tucker and Sampson (25) pp. 463-467; Ridgway and Davis (1) p. 569; Lemmon (7) pp. 79-104; Tucker and Sampson (30) pp. 567-571; Engineering and Mining Journal (30) p. 84. **3**, Copper Queen, 4 miles south of Oasis (sec. 7, T. 6 S., R. 37 E., M.D.), Kerr (6) p. 141. **4**, Northeast flank of the Inyo Mountains (sec. 19, T. 8 S., R. 37 E., M.D.) ibid. p. 141. **5**, Trail Canyon, Sheephead claim (T. 19 S., R. 46 E., M.D.) ibid. p. 147. **5**, Occurs in the Darwin Mines in well-formed crystals, Butner (1) pp. 1-6.

Kern County: **1**, Translucent to transparent crystals of scheelite up to 1 inch across have been found at the Aldridge mine (NW$\frac{1}{4}$ sec. 27, T. 25 S., R. 32 E., M. D.) Durrell (p. c., '45). Schaller (46) p. 237 has shown so-called cuproscheelite from the Green Monster mine 12 miles east of White River to be a mixture of scheelite and cuprotungstite. A number of deposits occur in the neighborhood of Cedar Creek and Isabella, Storms (15) p. 768, Mining and Scientific Press (41) p. 887, Hess and Larsen (17) pp. 263, 265, Tucker (4) p. 315, Tucker and Sampson (29) pp. 332, 333, (30) pp. 575-579, Dale (1) p. 1896, Tucker and Sampson (32) pp. 61-64, 121. Other localities: Hess (10) p. 35, (12) p. 988, (14) p. 48, Hulin (1) pp. 70, 97. **2**, Gorman district, with cassiterite and ludwigite, Page (3) p. 202. **3**, Cottonwood Canyon (T. 30 S., R. 35 E., M.D.) Kerr (6) p. 151. **4**, Indian Creek, 12 miles east of Caliente (T. 30 S., R. 33 E., M.D.), ibid. p. 151.

Madera County: **1**, Many occurrences in the Jackass Creek area (T. 4 S., R. 24, 25 E., M.D.) Kerr (6) p. 157, Trengrove (1) p. 4. **2**, North fork, San Joaquin River (T. 8 S., R. 23, 24 E., M.D.), ibid. p. 156. **3**, Yellowjacket (sec. 3, 4, 10, T. 5 S., R. 23 E., M.D.) ibid. p.

157, Trengrove (1) p. 4. **4**, Scheelite has been reported since 1947 in various localities in the following areas: sec. 10, T. 9 S., R. 22 E., M.D., and sec. 4, 5, T. 7 S., R. 22 E., M.D., Logan (24) p. 466.

Marin County: **1**, Scheelite has been found in the Tomales Bay area, Anon. (17) p. 4.

Mono County: **1**, In tactite north of Tioga Pass (sec. 6, T. 2 N., R. 25 E., M.D.) Kerr (6) p. 160. **2**, Topaz Lake district (T. 7, 8, 9 N., R. 22, 23 E., M.D.) ibid. p. 160.

Placer County: **1**, Scheelite in tactite zones has been reported from 11 miles west of Lake Tahoe on the upper reaches of the Rubicon River, Anon. (14) p. 2.

Riverside County: **1**, Alice group (sec. 25, 36, T. 1 S., R. 23 E., S. B.), Kerr (6) p. 162. **2**, Six miles southwest of Perris, ibid. p. 161. **3**, Beatty claims, 6 miles west of Perris (sec. 32, 33, 34, T. 4 S., R. 4 W., S. B.), ibid. p. 161.

San Bernardino County: **1**, Very important deposits of scheelite occur in the Atolia and Stringer districts, near Randsburg, G. C. Brown (1) p. 522, Cloudman et al. (1) p. 830, Hulin (1) pp. 70, 97. **2**, It occurs with bismutosphaerite (?) in the Morongo district, Hess and Larsen (17) p. 262, Tucker (4) p. 374. **3**, With cassiterite in the Ivanpah Mountains (sec. 30, T. 15 N., R. 14 E., S. B.), Tucker and Sampson (30) p. 585, (15) p. 498. Other occurrences: Surr (3) p. 9; J. H. Williams (1) p. 545; Engineering and Mining Journal (24) p. 730; Cloudman et al. (1) p. 839; W. W. Bradley (26) p. 345; Tucker and Sampson (27) p. 78; Gardner (1) p. 261; Tucker and Sampson (30) pp. 584, 585; (32) p. 68. **4**, Scheelite occurs in tactite at the Starbright tungsten mine, 25 miles Northwest of Barstow (sec. 19, T. 12 N., R. 1 E., S. B.), Anon. (16), p. 1, Wright, L. A., et al. (5) p. 152, Hazenbush (1) p. 201.

San Diego County: **1**, In aplite dikes in Mason Valley, 60 miles east of San Diego, close to the Mexican border, Kerr (6) p. 165. **2**, In tactite, in the Laguna Mountains (sec. 28, T. 15 S., R. 4 E., S. B.) ibid. p. 165.

Trinity County: **1**, Stewart Fork, 10 miles northwest of Minersville (sec. 10, T. 35 N., R. 9 W., M.D.) Kerr (6) p. 166.

Tulare County: **1**, Mineral King, near Empire mine (sec. 11, 16, T. 17 S., R. 31 E., M.D.) Kerr (6) p. 167. **2**, Near Middle Fork, Kaweah River (sec. 13, T. 16 S., R. 29 E., M.D.), ibid. p. 167. **3**, Brush Creek near Fairview (sec. 36, T. 22 S., R. 32 E., M.D.) ibid. p. 168. **4**, Tule Indian Reservation (sec. 7, T. 22 S., R. 30 E., M.D.), ibid. p. 168.

Tuolumne County: **1**, Dorothy Lake, Yosemite National Park (sec. 20, T. 4 N., R. 22 E., M.D.) Kerr (6) p. 168. Additional reference to county, Logan (23) p. 81.

Yuba County: **1**, Stephens, Dobbins Ranch (sec. 7, T. 17 N., R. 7 E., M.D.), Kerr (6) p. 169.

References to other localities of lesser commercial importance are listed as follows by county: Alpine: Tucker and Sampson (30) p. 565, O. P. Jenkins (1) p. 311; Amador: W. W. Bradley (28) p. 498; Calaveras: W. W. Bradley (30) p. 491; El Dorado: W. W. Bradley (32) p. 318; Fresno: Engineering and Mining Journal (19) p. 1045, W. W. Bradley (2) p. 470, Tucker and Sampson (30) pp. 565, 566, Chesterman (1) p. 276, Laizure (9) p. 54, Thickstun (1) p. 29; Humboldt: Forstner et al. (3) p. 372; Madera: Tucker and Sampson (30) p. 580, W. W.

Bradley (31) p. 294, Laizure (9) p. 55, Thickstun (1) p. 79; Mariposa: W. W. Bradley (29) p. 311, Tucker and Sampson (30) p. 580; Mono: Loew (1) p. 656, Hess and Larsen (17) p. 277, Mayo (4) pp. 83, 84, R. J. Sampson (14) p. 147, Lemmon (6) pp. 581-593; Nevada: Mining and Scientific Press (22) p. 124 [First discovery of the mineral in California], Hanks (12) p. 353, E. M. Boyle (1) p. 29, Farmin (3) p. 224; Plumas: Tucker and Sampson (30) p. 581; Riverside: Hess and Larsen (17) p. 260; Tucker and Sampson (30) p. 587, (33) p. 125; San Diego: Tucker (10) p. 353, Tucker and Sampson (30) p. 587, (35) pp. 155-157, Symons (4) p. 364; Shasta: Partridge (1) p. 318, Tucker and Sampson (30) p. 587; Sierra: S. M. B. (20198), Durrell (p.c. '45); Trinity: J. C. O'Brien (2) p. 142; Tulare: Franke (1) p. 464, Tucker and Sampson (30) p. 588, Partridge (1) p. 319; Laizure (9) p. 57, O. P. Jenkins (1) pp. 172-179; Tuolumne: Hamilton (4) p. 130, W. W. Bradley (31) p. 286, Wright, L. A., et al. (5) p. 139.

SCOLECITE

Hydrous calcium and aluminum silicate, $CaAl_2Si_3O_{10}\cdot 3H_2O$

Monoclinic. Crystals slender prismatic; also massive, and fibrous. Cleavage nearly perfect prismatic. Vitreous luster, silky when fibrous. color white. H. = 5-5½. G. = 2.16-2.4.

B.B. curls up and fuses to a white enamel. Gelatinizes with acids.

Scolecite is a zeolite formed as a secondary mineral in cavities of igneous rocks and sometimes as veins in such rock.

Plumas County: 1, It occurs as a hydrothermal mineral in small veinlets of finely radial fibers at the Engels mine, Graton and McLaughlin (4) p. 18.

SCORODITE

Hydrous ferric arsenate, $FeAsO_4\cdot 2H_2O$

Orthorhombic. Aggregates of small crystals; also earthy. Brittle. Vitreous luster. Color pale leek green, liver brown. Streak white. H. = 3½-4. G. = 3.1-3.3.

A slight coating of arsenic can be obtained on charcoal when scorodite is reduced, and the residue becomes magnetic. The arsenic ring can be obtained by fusing in a closed tube with a splinter of charcoal. Gives water in a closed tube. Soluble in hydrochloric acid.

Imperial County: 1, Scorodite from this county is represented by S. M. B. (19794).

Inyo County: 1, Scorodite occurred in the Noonday mine, near Tecopa, Woodhouse (p. c., '45).

Kern County: 1, Scorodite is reported to occur with arsenopyrite at the Contact mine, sec. 10, T. 10 N., R. 15 W., S.B., Tucker (37) p. 207.

Mariposa County: 1, Pale-green crystals of scorodite were found as an alteration product of arsenopyrite associated with pitticite on the South Fork of Merced River, near the mouth of Devils Gulch, A. F. Rogers (7) p. 375.

San Diego County: 1, It was found with arsenopyrite near Moreno Lake, Hamilton (4) p. 759, S. M. B. (19699).

Sierra County: 1, Small quantities of scorodite have been found in the Alleghany district, Lindgren (20) p. 52.

Tuolumne County: 1, Scorodite has been reported as druses and crusts of gray-green octahedral crystals, Goudey (3) p. 12.

SCORZALITE

Basic phosphate of aluminum, magnesium, and ferrous iron, $(Mg,Fe)Al_2(PO_4)_2(OH)_2$ (an iron-rich lazulite)

Monoclinic, prismatic. Crystals acutely pyramidal, massive, compact, granular. Indistinct to good cleavage, fracture, uneven. Brittle. H. = 5.5-6. G. = 3.08-3.14. B.B. infusible, slowly soluble in hot acids.

Mono County: 1, Occurs associated with hematite and quartz in a pegmatite-like mass in lower group of patented claims of Mono County mine on the west slope of White Mountains. Woodhouse (p.c. '54).

* SEARLESITE, 1914

Hydrous sodium borosilicate, $NaB(SiO_3)_2 \cdot H_2O$

Monoclinic. Prismatic. In radiate-fibrous spherulites. One cleavage perfect. Color white. Very soft. G. = about 2.45.

Fuses easily to a clear glass. Easily soluble in hydrochloric acid and somewhat soluble in water.

San Bernardino County: 1, Searlesite occurred as crusts of white spherulites at Searles Lake. It was described and named by Larsen and Hicks (1) p. 438 with analysis by Hicks. See also H. S. Gale (13) p. 292.

SiO_2	B_2O_3	Na_2O	K_2O	MgO	FeO	Al_2O_3	H_2O
56.41	16.26	12.78	1.00	1.82	1.89	0.37	9.47

SELENITE

See gypsum

SENARMONTITE

Antimony trioxide, Sb_2O_3

Isometric. Crystals octahedrons. In crusts or granular massive. H. = 2. G. = 5.3. Colorless, grayish.

Inyo County: 1, Senarmontite was found with cervantite and stibnite at the property of the Skidoo Mining Company, Mining and Scientific Press (38) p. 368.

Santa Clara County: 1, Possible crystals of senarmontite were reported from the county by Goldsmith (3) p. 369.

SEPIOLITE—Meerschaum

Hydrous magnesium silicate, $H_4Mg_2Si_3O_{10}$

Orthorhombic. Fibrous, compact. Earthy texture and smooth feel. Dull luster. Color white. H. = 2-2½. G. = 2. When dry floats on water.

Difficult to fuse. Heated in closed tube, gives off water. Moistened with cobalt nitrate and intensely heated, assumes a pink color. Soluble in hydrochloric acid without forming a jelly.

Inyo County: 1, Sepiolite was mentioned by Hanks (12) p. 353 as possibly occurring at the Half Dollar mine.

Riverside County: 1, Sepiolite occurs as fine interlocking fibers in small veins in calcite at Crestmore, Daly (1) p. 651.

SERENDIBITE

$10(CaMg)O \cdot 5Al_2O_3 \cdot B_2O_3 \cdot 6SiO_2$

In irregular grains microscopically twinned. H. = 6-7. G. = 3.4. Color blue.

Riverside County: **1**, A massive granular aggregate of dark-blue, glassy serendibite occurs in thin bands in limestone at the new city quarry, 2 miles south of Riverside, Richmond (1) p. 725.

SERICITE

See muscovite

SERPENTINE

Hydrous magnesium silicate, $H_4Mg_3Si_2O_9$

Monoclinic. Commonly massive, compact to fibrous. Cleavage one direction distinct. Subresinous luster. Color leek green to blackish green, brownish and nearly white. Streak white. Feels smooth, sometimes greasy. H. = 2.5-4. G. = 2.21-2.65.

Fusibility = 6. Soluble in hydrochloric acid, but without forming a jelly. Gives water in a closed tube. A heavy white precipitate is obtained with sodium phosphate.

Besides the ordinary massive serpentine, ***bastite, chrysotile, marmolite, picrolite,*** and ***williamsite*** are varieties which have been found in California.

Serpentine is an extremely common mineral, and frequently makes up the major part of the rock known as serpentine. It is an alteration product of basic igneous rocks rich in magnesian silicates. The only variety of commercial importance is fibrous or asbestiform, known as *chrysotile,* or chrysotile asbestos, which occurs as narrow veins in the massive material, mostly too narrow to be of value. The massive serpentine rock ranges in color from light green to greenish black, but very little of it can be utilized as an ornamental stone on account of its foliated and sheared structure.

Serpentine is abundant in the Coast Ranges from Del Norte County to San Diego County, and on the west flank of the Sierra Nevada. Some important or interesting localities are:

Amador County: **1**, A deposit of chrysotile has been quarried 2 miles west of Plymouth (N. R.). **2**, Veins of chrysotile occur in a dark-green serpentine at the Mace mine, 2½ miles east of Ione, Tucker (1) p. 5.

Calaveras County: **1**, Veins of short-fiber chrysotile occur in the serpentine on the ridge northwest of the Stanislaus River, about 6 miles southeast of Copperopolis (secs. 21, 22, T. 1 N., R. 13 E., M. D.), Tucker (1) p. 55, Diller (17) p. 53.

El Dorado County: **1**, Veins of fibrous chrysotile are found at French Hill, 6 miles north of Greenwood (sec. 36, T. 13 N., R. 9 E., M. D.), Logan (9) p. 404, (19) p. 207. **2**, A good quality of fibrous chrysotile occurs near Georgetown, (sec. 24, T. 12 N., R. 10 E., M. D.) Logan (19) p. 207.

Fresno County: **1**, Serpentine containing veinlets of chrysotile occurs in the Dinuba quadrangle (sec. 22, T. 11 S., R. 23 E., M. D.) as cores in nodules, altered outwardly to talc and actinolite, Macdonald (4) p. 276. **2**, It is found near Hernandez, E. Sampson (1) p. 138. **3**, At the head of Los Gatos Creek in fine crude fibers, Diller (19) p. 551.

Inyo County: **1**, Long fibers of serpentine asbestos occur at Cerro Gordo (N. R.). **2**, Veins of cross-fiber asbestos (chrysotile) occur in dolomite in Death Valley, at the Indian Camp asbestos mine, Murdoch (p.c. '51).

Kern County: **1**, Chrysotile veins occur in serpentine in Jawbone Canyon (sec. 7, T. 30 S., R. 36 E., M. D.) G. C. Brown (1) p. 476.

Lake County: **1**, Becker (4) p. 111 gives analyses by Melville of the serpentine at Sulphur Bank. **2**, Fibrous chrysotile in serpentine occurs north of Middletown, Bowles and Stoddard (1) p. 300.

Los Angeles County: **1**, Serpentine marble has been quarried commercially on Santa Catalina Island in Potts Valley, F. J. H. Merrill (2) p. 483.

Mariposa County: **1**, Bastite occurs in considerable amount in the Mary Harrison mine south of Coulterville. A. Knopf (11) p. 36. **2**, At Three Buttes (secs. 8, 16, 17, T. 6 S., R. 16 E., M. D.) California Academy of Sciences Proceedings (1) p. 110.

Monterey County: **1**, Fibrous chrysotile occurs in 1½-foot veins in Burro Gorge near Jolon, Laizure (3) p. 28.

Napa County: **1**, Chrysotile asbestos in short fibers occurs in Steel Canyon, L. L. Root (2) p. 26.

Nevada County: **1**, Zones of short fibrous chrysotile occur near the old Fairview mine, in the Washington district (N. R.). **2**, Picrolite occurred in the Maryland mine, Grass Valley, S. M. B. (7464).

Placer County: **1**, Long fibers of chrysotile occur at Iowa Hill (secs. 28, 33, T. 15 N., R. 10 E., M. D.), L. L. Root (5) p. 237. **2**, Broad sheets and long fibers of chrysotile occur in the American River Canyon near Towle, Diller (17) p. 53.

Plumas County: **1**, Diller (6) p. 374 gives an analysis of serpentine from Greenville by Melville.

Riverside County: **1**, Small grains of serpentine (probably mixed with deweylite, Daly (1) p. 650) occur in the white crystalline limestone at Crestmore, Eakle (15) p. 334.

San Benito County: **1**, Becker (4) p. 110 gives an analysis by Melville of a light-green marmolite from New Idria. **2**, It occurs on Clear Creek, near Hernandez secs. 10, 15, T. 18 S., R. 11 E., M. D.) Laizure (4) p. 223.

San Bernardino County: **1**, Good fibers occur in an undeveloped property near Cronise, Tucker and Sampson (16) p. 296.

San Francisco County: **1**, Newberry (1) p. 66 gives an analysis of the serpentine of San Francisco.

Shasta County: **1**, Large fibrous masses of chrysotile asbestos occur near Sims Station, Logan (7) p. 7, E. Sampson (2) p. 316, Averill (9) p. 113.

Sierra County: **1**, Serpentine asbestos occurs on the west bank of Goodyear Creek, and elsewhere in Sierra County, W. W. Bradley (11) p. 154.

Siskiyou County: **1**, Williamsite, or gem serpentine, occurs near Indian Creek, north of Happy Camp on the Klamath River, Melhase (3) p. 8.

Trinity County: **1**, Chrysotile has been mined at the Jones Brothers asbestos mine, 2 miles northwest of Carrville, Averill (3) p. 26, J. E. Allen (2) p. 117. Localities are also mentioned in Logan (7) p. 7, (9) p. 128.

Tulare County: **1**, Chrysotile is found in the serpentine east of Lindsay on Tule River (T. 20 S., R. 29 E., M. D.), Tucker (3) p. 905.

* SICKLERITE, 1912

Hydrous iron, manganese, and lithium phosphate, $Fe_2O_3 \cdot 6MnO \cdot 4P_2O_5 \cdot 3(Li,H)_2O$

Orthorhombic? In cleavable masses. Color dark brown. Streak light brownish yellow. H. = 4. G. = 3.45. Easily fusible. Soluble in acid.

San Diego County: **1**, Sicklerite, resulting from the alteration of lithiophilite, occurs in cleavable masses, at the Vanderburg-Naylor mine on Heriart Hill near Pala. It was analyzed and named by Schaller (29) p. 144.

MnO	CaO	Fe_2O_3	Mn_2O_3	P_2O_5	H_2O	Li_2O	Insol.	
33.60	0.20	11.26	2.10	43.10	1.71	3.80	4.18 = 99.95%	G. = 3.45

SIDERITE

Ferrous carbonate, $FeCO_3$

Hexagonal-rhombohedral; scalenohedral. Crystals with curved faces; also massive, granular. Cleavage perfect rhombohedral. Brittle. Vitreous to pearly luster. Color ash gray to dark brown. Streak white. H. = 3½-4. G. = 3.8.

Becomes magnetic on heating. Dissolves with brisk effervescence in hot hydrochloric acid.

Siderite is occasionally found in the mining regions in drusy crystallizations associated with pyrite and galena, but does not appear to be common in California.

Calaveras County: **1**, Siderite occurs with albite, calcite, and quartz at Campo Seco, (N. R.).

El Dorado County: **1**, It occurs with calcite and albite at the Red Hill mine, Kelsey mining district, (N. R.).

Imperial County: **1**, It occurs with specular hematite in quartz near Bard, (N. R.).

Inyo County: **1**, Masses of siderite have been found at the Custer mine, Coso district, S. M. B. (7618). **2**, Siderite occurs with pyrite, pyrrhotite, and chalcopyrite in a quartz vein at the Curran mine, half a mile northeast of Panamint, Murphy (2) p. 314, R. J. Sampson (7) p. 367. **3**, At the Mountain Girl, 4 miles south of Panamint, R. J. Sampson (7) p. 371.

Los Angeles County: **1**, Massive siderite occurs in the Tujunga Canyon, Hanks (12) p. 354. **2**, It has been found with pyrrhotite and annabergite in Pacoima Canyon 12 miles east of San Fernando, D'Arcy (3) p. 269.

Mariposa County: **1**, It was found with calcite at Devils Gulch (N. R.).

Mono County: **1**, It occurs with limonite and hematite near Benton, A. L. Ransome (2) p. 190.

Plumas County: **1**, It was found with the copper minerals of the Engels mine, Graton and McLaughlin (4) p. 19.

Riverside County: **1**, Occurs with pyrrhotite in the old Dominion mine. Larsen, E. S., Jr., Everhart, D. L., Merriam, Richard (18), p. 48.

San Diego County: **1**, Siderite has been recognized from Pala, Kunz (23) p. 942.

Santa Clara County: **1**, A deposit of siderite occurs on the Weber Ranch, in Los Animos Hills, 3 miles northeast of Madrone, (N. R.). **2**, Siderite occurs in large masses on Red Mountain, (N. R.). **3**, On Coyote Creek 4½ miles east of Madrone, (N. R.).

SIDEROTIL

Hydrous ferrous sulfate, $FeSO_4 \cdot 5H_2O$

Color white.

Contra Costa County: **1**, Found in the Mount Diablo quicksilver mine (SE¼ sec. 29, T. 1 N., R. 1 E., M. D.) as a dehydration product of melanterite, C. P. Ross (2) p. 44.

SILLIMANITE—Fibrolite

Aluminum silicate, Al_2SiO_5

Orthorhombic. In long slender prisms. Fibrous and columnar massive forms. One cleavage perfect. Vitreous luster. Color grayish brown, grayish white, olive green. Streak uncolored. H. = 6-7. G. = 3.23-3.24.

The reactions are identical to those for andalusite; the two minerals are generally differentiated by their dissimilar structure.

Sillimanite is a constituent of metamorphic gneiss and schist, often with kyanite, andalusite, and staurolite.

Inyo County: **1**, Random fibers of sillimanite are found abundantly in schist at the scheelite deposit in Deep Canyon, west of Bishop, A. Knopf (6) p. 233. **2**, Sillimanite occurs massive near Laws, (N. R.).

Kern County: **1**, Sillimanite occurs in schists of the Kernville series, near Cook peak, W. J. Miller (6) p. 338.

Los Angeles County: **1**, It occurs in schists in the San Rafael Hills, W. J. Miller (7) p. 5. **2**, It was observed by Beverly (1) pp. 344, 351, at the graphite deposits in San Francisquito, Kagel, and Elizabeth Lake Canyons, in the western part of the San Gabriel Mountains.

Mariposa County: **1**, It occurs in the schists near Mariposa in minute silvery prisms, Turner (12) p. 690.

San Bernardino County: **1**, It occurs in schist at Ord Mountain, 15 miles southeast of Daggett, (N. R.). **2**, It probably occurs in the corundum gneiss at Cascade Canyon, Foshag (p. c., '46).

San Diego County: **1**, It is a constituent of the dumortierite gneiss at Dehesa, Schaller (7) p. 96. **2**, It occurs 4 miles southeast of Fallbrook, G. A. Waring (2) p. 359. **3**, Abundant sillimanite up to 2 centimeters in size occurs in schists south and east of Ramona, and **4**, 2 miles south of Mesa Grande, R. Merriam (p. c., '46). **5**, Abundant and widespread occurrences of sillimanite as needles in quartz-muscovite-sillimanite schist are found south and east of Ramona (T. 12 S., R. 2 E., S. B.), Merriam (4) p. 228. **6**, In the Mesa Grande area needles as much as 1 to 2 cm in size occur in the schists, ibid. p. 228. **7**, Sillimanite occurs in gneiss at the entrance to Palm Canyon, Borego Valley, C. Durrell (p.c. '48). **8**, Sillimanite is abundant in blocks of breccia in Split Mountain Canyon, C. Durrell (p.c. '48).

Tuolumne County: **1**, Sillimanite from this county has been analyzed by H. N. Stokes, Clarke (10) p. 317.

SILVER

Native silver, Ag

Isometric. Crystals rare. Acicular, reticulated, or arborescent; also massive. Ductile and malleable. Luster metallic. Color and streak silver white, often tarnished gray to black. H. = 2½-3. G. = 10.1-11.1, pure 10.5.

B.B. on charcoal fuses easily to a silver-white globule. Easily soluble in nitric acid, giving on addition of hydrochloric acid a curdy white precipitate of silver chloride, which turns dark on exposure to light.

Native silver has not been found in any large masses in the state, yet it is present in many gold and copper districts, and occasionally arborescent crystal groups, wires, and thin sheets are found. It is more common in the silver-lead districts, where it often occurs near the walls of veins and intrusive dikes.

Alpine County: **1**, Good specimens of native silver have come from the Silver Mountain district, W. P. Blake (9) p. 21, R. W. Raymond (6) p. 12.

Calaveras County: **1**, It occurred in arborescent forms with the copper ore at Quail Hill, Mining and Scientific Press (4) p. 5.

Del Norte County: **1**, It was found with tetrahedrite at the Occidental mine, Crawford (2) p. 58.

Fresno County: **1**, Silver occurred at Millerton, Hanks (15) p. 135.

Inyo County: **1**, Occasional sprinklings of native silver occur with argentite in the quartz-calcite veins of Saline Valley, about 30 miles northeast of Mount Whitney, T. Warner (1) p. 938. **2**, At the Eclipse mine, near Mazourka Canyon, Goodyear (3) p. 263. **3**, Thin sheets of silver occur at the Sorba mine, near Darwin, Kelley (4) p. 543. **4**, It occurred in the Cerro Gordo mines, Wheeler (3) p. 62. **5**, It was found in the Panamint district, Stetefeldt (1) p. 259.

Kern County: **1**, It occurs with the silver minerals in the Amalie district and near Garlock (N. R.).

Los Angeles County: **1**, Native silver was associated with argentite, and with cobalt and nickel minerals, at the Kelsey mine, near San Gabriel Canyon, Storms (4) p. 244. **2**, At the O. K. mine, Irelan (4) p. 47. **3**, Native silver is found at the Maria mine, Soledad Canyon, W. P. Blake (9) p. 21.

Madera County: **1**, Silver occurs in quartz veins at the Sullenger property, 3 miles northwest of Agnew Meadows on the eastern slope of Middle Fork Canyon, Erwin (1) p. 71.

Mariposa County: **1**, It occurs with proustite at the Silver Lane (sec. 15, T. 6 S., R. 19 E., M. D.), Laizure (8) p. 44.

Mono County: **1**, It occurs in narrow veins cutting granitic rocks on Blind Spring Hill at Benton. Good specimens have come from the Diana and Comanche mines of this district, Hanks (15) p. 135. **2**, Some native silver occurs in the Silverado mine in the Patterson mining district, Whiting (1) p. 359. **3**, At Bodie it has been found in wire and flake form with crystallized argentite, with the copper-gold ores, Hanks (15) p. 135, Whiting (1) p. 391. **4**, Native silver has been found at the Dunderberg and Napoleon mines, on Castle Peak, Wheeler (4) p. 184.

Napa County: **1**, It occurs with argentite and cerargyrite at the Calistoga mines, L. L. Palmer (1) p. 28.

Placer County: **1**, Silver occurred at the Gold Blossom and the California mines in the Ophir district, Lindgren (7) p. 272. **2**, It also occurred at the Valley View, 6 miles south of Lincoln, as films on a talcose mass, Silliman (7) p. 351.

Plumas County: **1**, Native silver has been found in the old Pocahontas mine, associated with millerite, native copper, and cuprite, Crawford (1) p. 69.

San Bernardino County: **1**, Silver was first discovered in the Calico district about 1874, and worked for quicksilver. The ore carried cerargyrite and native silver, Mining and Scientific Press (21) p. 98, Lindgren

(1) p. 717, and Storms (2) p. 382, (4) p 337. **2**, It occurred in the Grapevine district, S. M. B. (4234). **3**, The Silver Reef district (N. R.), and the Silver Mountain district (N. R.), have produced some native silver with the cerargyrite and embolite. **4**, Native silver with gold occurs in the Avawatz Mountains, Irelan (3) p. 501. **5**, Native silver was reported from the San Gabriel mine, Mining and Scientific Press (22) p. 152. **6**, It was found with cerargyrite and embolite at the Alta mine, 1¼ miles east of Riggs, Tucker (4) p. 359, Tucker and Sampson (16) p. 267. **7**, Small flecks of silver were noted on the 150-foot level of the Kelley mine near Randsburg, Carpenter (2) p. 135. **8**, Native silver and cerargyrite are found in the Waterman mine, sec. 3, T. 10 N., R. 2 W., S. B., 4 miles north of Barstow, Wright et al. (5) p. 139.

San Mateo County: **1**, Native silver is recorded from a well 478 feet deep at the Redwood City mine, Hanks (14) p. 94.

Shasta County: **1**, Native silver is rare in the copper deposits of this county, but a few arborescent specimens have come from the Bully Hill, Afterthought, and other mines, Aubury (1) p. 65, A. C. Boyle, Jr. (1) p. 98. **2**, Fine crystallized silver occurred in the old Excelsior mine, Copper City, Fairbanks (2) p. 32. **3**, Native silver in arborescent crystal groups, associated with stephanite, tetrahedrite, galena, and sphalerite, in a calcite-quartz gangue, occurs at the Igo Consolidated mines, (secs. 17, 18, T. 31 N., R. 6 W., M. D.), Becker (2) p. 24, Laizure (1) p. 526.

SISERSKITE

See iridosmine

SMALTITE

Cobalt arsenide, $(Co,Ni)As_{3-x}$ ($x = 0.5$ to 1.0)

Isometric. Generally massive. Brittle. Metallic luster. Color tin white. Streak grayish black. H. = 5½-6. G. = 6.1-6.8.

The roasted mineral becomes magnetic. Gives a white coating of arsenic trioxide on charcoal. A cobalt-blue bead of borax is obtained, using the roasted mineral.

Calaveras County: **1**, Smaltite has been found with erythrite in a small stringer at the Mar John mine near Sheepranch, (NW¼ sec. 21, T. 4 N., R. 14 E., M. D.), Logan (7) p. 4.

Los Angeles County: **1**, Smaltite coated with erythrite occurred with the native silver and argentite at the old Kelsey and O. K. mines near San Gabriel Canyon, Irelan (4) p. 47.

Inyo County: **1**, Smaltite has been found with erythrite, annabergite, and argentite at the Bishop silver and cobalt mine near Long Lake (sec. 14, T. 9 S., R. 31 E., M. D.), Woodhouse (p. c., '36).

Lassen County: **1**, It is recorded from this county, with annabergite, Irelan (4) p. 47, S. M. B. (9981).

Napa County: **1**, Smaltite has been found in thin seams with erythrite in the serpentine rock of Berryessa Valley (N. R.).

Nevada County: **1**, It occurs in the Meadow Lake district (N. R.).

Siskiyou County: **1**, It has been reported from Callahan with erythrite, W. W. Bradley (28) p. 497.

SMITHSONITE

Zinc carbonate, $ZnCO_3$

Hexagonal-rhombohedral. Drusy crystals; usually reniform, botryoidal, or stalactitic; often bone-like. Cleavage perfect rhombohedral. Brittle. Vitreous luster. Color white, grayish, bluish, greenish, brownish. Streak white. H. = 5½. G. = 4.30-4.45.

B.B. infusible. With sodium carbonate on charcoal, becomes yellow while hot and white when cold. Moistened with cobalt nitrate and intensely heated, assumes the yellowish-green color characteristic of zinc minerals. Effervesces readily in hydrochloric acid.

Smithsonite is a secondary mineral often found in silver-lead districts. It is usually associated with galena, sphalerite, hemimorphite (calamine), and cerussite.

Inyo County: **1,** Smithsonite was found with cerussite at the Modoc mine (sec. 34, T. 19 S., R. 42 E., M. D.), Hanks (12) p. 368, S. M. B. (2177). **2,** It was also present at the Ignacio mine at Cerro Gordo with hemimorphite and willemite, Irelan (4) p. 47, A. Knopf (5) p. 97. **3,** An unusual stalactitic form of smithsonite occurs at Cerro Gordo, S. M. B. (19287). **4,** It occurs with hemimorphite at Camp Burgess (N. R.). **5,** It was found in the limestone footwall of the Cerro Gordo mine (N. R.). **6,** It occurred with cerussite and galena in limestone at the Redwing and Noonday mines, Resting Springs district, C. A. Waring and Huguenin (2) p. 104. **7,** It was common at the Minietta mine (N. R.). **8,** It occurred with galena and cerussite in limestone at the Ophir mine 10 miles northeast of Trona, C. A. Waring and Huguenin (2) p. 105. Yellow, cadmium-bearing smithsonite was obtained in the Cerro Gordo mine, S. M. B. (19297). **9,** It has been found at the Swansea mine, 2½ miles northeast of Keeler, Tucker (11) p. 501, and **10,** in the Leadfield district, ibid. p. 507. **11,** Small amounts are present in the Darwin district, Tucker (4) p. 294, Kelley (4) p. 546. **12,** In the Wild Rose district, Tucker and Sampson (32) p. 59. **13,** In the Panamint district, Murphy (2) p. 322. **14,** Smithsonite occurs with galena at the Lippincott lead mine, sec. 13, T. 15 S., R. 40 E., M. D., McAllister (2) pp. 1-10.

Kern County: **1,** Smithsonite occurred in drusy veins at the Jewett mine on Cottonwood Creek (N. R.). **2,** It was found on the Tejon Ranch (T. 9 N., R. 18 W., S. B.), Tucker and Sampson (32) p. 65.

Riverside County: **1,** Smithsonite occurs with copper and lead minerals at the Palisade zinc property, 2 miles from English siding on the California Southern Railroad, Tucker (4) p. 332.

San Bernardino County: **1,** It occurred with hemimorphite at the Cuticura mine, near Daggett, S. M. B. (11534). **2,** It occurred with cerussite, anglesite, linarite, and galena in dolomite at the Ibex mine, Black Mountains, 6 miles north of Saratoga Springs, Cloudman et al. (1) p. 821. **3,** At the Carbonate King mine (sec. 4, T. 15 N., R. 14 E., S. B.), Tucker and Sampson (33) p. 128, Wiebelt (1) p. 1. **4,** In the Clark Mountains, 5 miles northeast of Valley Wells (T. 17 N., R. 13 E., S. B.), Tucker (8) p. 95. **5,** With galena in the Ivanpah district, Tucker (4) p. 363.

Tulare County: **1,** Smithsonite has been found in the Silver Crown group (sec. 7, T. 23 S., R. 33 E., M. D.), Tucker and Sampson (29) p. 331.

SMOKY QUARTZ

See quartz

SOAPSTONE

See talc

SODA AMPHIBOLE

See amphibole

SODA MICROCLINE

See feldspar

SODA NITER—Chile Saltpeter

Sodium nitrate, $NaNO_3$

Hexagonal-rhombohedral. Crystals, massive, incrustations. Cleavage perfect rhombohedral. Vitreous luster. Color white, reddish, grayish, yellowish. H. = 1½-2. G. = 2.24-2.29.

Fuses with strong yellow flame of sodium. Heated in a bulb tube with potassium bisulphate, gives off red vapors of nitrous oxide. Soluble in water. Taste cooling. In general, in California, the mineral is not recognized as such, but only by analysis of solubles from "niter beds."

Nitrates can exist in solid form only in arid regions, and are therefore peculiar to desert lands, where they are sometimes left as white incrustations by evaporation. Some of these white crusts may be found in the California desert land, but no important deposits are known, Mansfield and Boardman (4) pp. 23-30.

Imperial County: **1**, Soda niter has been found along the shoreline of the old Salton Sea, near the Mud Volcanoes, H. S. Gale (1) p. 27.

Inyo County: **1**, Crusts containing soda niter and niter occurring along the Amargosa River and along shore lines and old beaches of Death Valley, were reported by G. E. Bailey (2) p. 169. **2**, Crusts of soda niter and niter occur near Shoshone, Noble (4) p. 71. **3**, The Confidence, Upper Canyon, Zabriskie, Ratcliff claims, and Furnace Creek nitrate fields contain small amounts of soda niter, Noble et al. (1) pp. 22-88.

Merced County: **1**, It occurs in crusts with other sodium salts, from Merced Bottom, Hilgard (1) p. 25, Laizure (3) p. 182.

Riverside County: **1**, Minor amounts are found in the Vivet Eye area (T. 1 S., R. 23, 24 E., S. B.), Turner (28) p. 636, Noble (4) p. 54.

San Bernardino County: **1**, White incrustations containing soda niter and niter occur along the Amargosa River, G. E. Bailey (2) p. 169. **2**, Small amounts of soda niter have been found in the Calico district, A. Williams (1) p. 599, and at Searles Lake. **3**, The Lower Canyon, Saratoga, Upper Canyon, Barstow syncline, Coolgardie Lake, Pilot, Leach Lake, Owl Spring, Twenty-Nine Palms, West Well, Beal, Vidal, and Danby Lake nitrate fields contain small amounts of soda niter, Noble (4) pp. 10-32.

Tulare County: **1**, Alkaline crusts containing soda niter with other soda salts occur in the San Joaquin Valley, near Tulare, Hilgard (1) p. 25.

SODA ORTHOCLASE

See feldspar

SODA PYROXENE

See pyroxene

† SONOMAITE, 1877

See pickeringite

SPECULARITE

See hematite

SPESSARTITE

See garnet

SPHALERITE—Zincblende—Black Jack

Zinc sulphide, ZnS

Isometric; hextetrahedral. Imperfect crystals, granular and massive. Cleavage perfect dodecahedral. Brittle. Resinous luster. Color yellow, brown, black. Streak colorless to yellowish brown. H. = 3½-4. G. = 3.9-4.1.

A slight coating, yellowish white when hot and whitish when cold, is obtained by intense heating. A few drops of cobalt nitrate added to the assay and intensely heated gives a yellowish-green color, which is chacteristic of zinc minerals. Gives strong hydrogen sulphide odor when dissolved in hydrochloric acid.

Sphalerite is very common and is prevalent in most of the mining regions, It varies from clear light-brown to very dark-brown, almost black masses. Its typical associate is galena, but it is also often intimately mixed with pyrite, chalcopyrite, tetrahedrite, arsenopyrite, and lead-silver minerals. In the smelting of zinc-bearing ores few of the smelters have endeavored to save the zinc.

Only the more interesting occurrences can be listed in any detail. For other occurrences, references will be given by counties.

Inyo County: **1**, Cleavage pieces of sphalerite up to 3 inches across, with fluorite and galena, have been found in the Darwin district, Defiance and other ore bodies, A. Knopf (4) p. 7, Kelley (4) p. 543.

Los Angeles County: **1**, The lead mines on Santa Catalina Island were rich in sphalerite, Hanks (12) p. 371, Tucker (12) pp. 33-38. **2**, Massive sphalerite with galena and pyrrhotite, occurs at the Indicator mine, 12 miles from the mouth of Pacoima Canyon, Tucker (4) p. 318.

Mariposa County: **1**, Triboluminescent sphalerite, a mixture of fine-grained sphalerite, barite, chalcopyrite, and kaolinite, which glows when rubbed, occurs at the Fitch mine (secs. 9, 10, T. 4 S., R. 15 E., M. D.), Eakle (5) p. 30, Eakle and Sharwood (6) p. 1000, Headden (1) p. 177.

Merced County: **1**, Triboluminescent sphalerite with barite has been found near Merced Falls, Laizure (3) p. 175.

Nevada County: **1**, Considerable masses of sphalerite, with other sulphides, are found in the Washington district, Meadow Lake, Wisker (1) p. 194. **2**, It is quite abundant in several of the mines in Grass Valley, Lindgren (12) p. 118.

Orange County: **1**, It is plentiful in the Blue Light mine, (secs. 11, 14, T. 5 S., R. 7 W., S. B.), Fairbanks (4) p. 115. **2**, Found with pyrrhotite and chalcopyrite on the north bank of San Juan Creek, in the southwest part of the Elsinore quadrangle, about 1½ miles east of the western quadrangle boundary. Vein several feet wide as an irregular replacement in Triassic sediments, Larsen, E. S., Jr., Everhart, D. L., Merriam, Richard (18), p. 48.

Placer County: **1**, Yellowish transparent blende occurs in the Ophir district (NE¼ sec. 17, T. 12 N., R. 8 E., M. D.), Lindgren (7) p. 273.

Riverside County: **1**, It is one of the minerals at Crestmore, Kelley (2) p. 141.

San Bernardino County: **1**, Large masses of sphalerite carry the silver values in some of the mines of the Silver Mountain district, 5 miles north of Adelanto and 1 mile west of route 395, Tucker and Sampson (16) p. 267.

Shasta County: **1**, An extensive ore body of finely divided sphalerite is found at the Hobbs mine, 6 miles southwest of Round Mountain, Crawford (1) p. 411.

Other references are to minor occurrences, listed by counties as follows: Alpine: Crawford (1) p. 373, Gianella (1) p. 342, W. W. Bradley (15) p. 488; Amador: Hulin (3) p. 352; Calaveras: Hanks (12) p. 371, Franke and Logan (4) p. 239; El Dorado: Logan (9) p. 406; Fresno: Aubury (4) p. 281; Imperial: Tucker (11) p. 267, Henshaw (1) p. 185; Inyo: A. Knopf (5) p. 104, Tucker (11) pp. 471, 473, Murphy (2) p. 321, Lemmon (5) p. 505, Tucker and Sampson (32) p. 59; Kern: Hulin (1) p. 84, Tucker and Sampson (21) pp. 290, 329, Simpson (1) p. 409, Engineering and Mining Journal (28) p. 62; Los Angeles: Storms (4) p. 243, R. J. Sampson (10) p. 187; Madera: W. W. Bradley (9) p. 548, Erwin (1) pp. 66, 70; Mariposa: J. B. Trask (8) p. 52; Mono: S. M. B. (7273), Mayo (4) p. 84, R. J. Sampson (14) pp. 139, 140; Orange: Fairbanks (4) p. 117; Placer: Logan (11) p. 286, (17) pp. 16, 23; Plumas: Preston (2) p. 467, Graton and McLaughlin (4) p. 15; Sacramento: W. P. Blake (9) p. 9; San Bernardino: Cloudman et al. (1) p. 790, Tucker and Sampson (17) p. 341, Erwin and Gardner (3) p. 302, Tucker and Sampson (32) p. 69, (33) p. 128; San Diego: F. J. H. Merrill (1) pp. 667, 668; San Mateo: Hanks (12) p. 371, (15) p. 135; Shasta: Aubury (4) p. 102, G. C. Brown (2) p. 808, Averill (4) pp. 7, 14, 50, 57; Sierra: E. M. Boyle (3) p. 4; Siskiyou: Averill (5) p. 280; Trinity: Averill (9) pp. 28, 34; Tulare: Hanks (12) p. 371, Franke (1) p. 436; Tuolumne: Tucker (1) p. 138, Oak Hill mine, sec. 30, T. 2 S., R. 14 E., M. D., Logan (23) p. 54.

SPESSARTITE

See garnet

SPHENE—Titanite

Calcium titano-silicate, $CaTiSiO_5$

Monoclinic. In wedge-shaped and flattened crystals. Sometimes massive and compact. Prismatic cleavage distinct. Adamantine luster. Color brown, yellow, gray, yellowish green, black. Streak white. H. = 5-5½. G. = 3.4-3.56.

Fusible at about 3. Slightly soluble in hydrochloric acid, and the solution, when boiled down with metallic tin, assumes a violet color due to the titanium.

Sphene is a common accessory mineral of the granites, gneisses, and schists of the state. It has been mentioned by many writers in their petrographical descriptions as a microscopic constituent of rocks.

Contra Costa County: **1**, Sphene is mentioned as an associate of crossite in the schists near San Pablo, by Palache (3) p. 184.

El Dorado County: **1**, Sphene was first observed in the state by W. P. Blake (17) p. 193, in the granite of Slippery Ford and other places of the Sierra Nevada.

Fresno County: **1**, Sphene is a constituent of the rocks at Fine Gold Gulch, Hanks (15) p. 138.

Inyo County: **1**, It occurs in small amount at the Wilshire gold mine west of Bishop, Turner (34) p. 888. **2**, It occurs in fair-sized crystals in the tactite at Darwin, Kelley (4) p. 540. **3**, Sphene occurs rather abundantly in large well-formed crystals (up to 2 inches in length), at the foot of the Palisade Glacier, D. I. Axelrod, (p.c. '46).

Imperial County (?): **1**, Chromiferous sphene from the "southern California desert area," was examined by Jaffe (1) p. 640.

Kern County: **1**, Sphene occurs with garnet, quartz, and feldspar in a contact-metamorphic limestone 200 yards east of Hobo Springs, near Havilah, Melhase (p.c., '36).

Los Angeles County: **1**, Green, brown and yellow sphene crystals up to $\frac{1}{8}$ inch are found in large boulders of diorite in alluvial fan material in Sierra Madre Canyon, Sierra Madre. Metzger (1) p. 56.

Marin County: **1**, It occurs as one of the minerals of the lawsonite schists on the Tiburon Peninsula, F. L. Ransome (3) p. 311.

Mendocino County: **1**, Pale yellowish crystals occur with lawsonite at Syke rock, 3 miles east of Longvale on the new Covelo road, T. 20 N., R. 14 W., M.D., Chesterman (p.c. '51).

Mono County: **1**, Minute grains of sphene are scattered through the andalusite at the mine of Champion Sillimanite, Incorporated, on the western slope of the White Mountains, 7 miles east of Molcalno, Woodhouse (2) p. 4.

Plumas County: **1**, It occurs as numerous irregular grains with apatite in the diorite country rock of the Superior mine, Graton and McLaughlin (4) p. 34.

Riverside County: **1**, Granular sphene in pale-brown grains is abundant in the quartz monzonite at Crestmore, Eakle (15) p. 330, and in some of the pegmatites, Woodford (11) p. 360. **2**, Small crystals of sphene occur in the gangue of the Eagle Mountain iron ores, Harder (6) p. 54. **3**, Sphene occurs as large yellow crystals with black tourmaline and quartz at a contact of granodiorite and quartzite in the West Riverside Hills, Eggleston (p. c., '36). 4, Crystals up to 1 by $\frac{1}{2}$ by $\frac{1}{2}$ inches appear in granodiorite on the northwest side of Deep Canyon (sec. 36, T. 6 S., R. 5 E., S. B.), Webb (7) p. 344.

San Bernardino County: **1**, Considerable sphene appears in the Iron Age ore deposit near Dale, Harder and Rich (4) p. 234.

San Diego County: **1**, Sphene is a minor associate of dumortierite at Dehesa, Schaller (7) p. 211.

San Mateo County: **1**, It is a notable constituent of the Montara granite near San Francisco, Lawson (2) p. 411.

Santa Clara County: **1**, Fine large crystals of sphene occur in the eclogites of Calaveras Valley, Murgoci (1) p. 388; **2**, and in the quartzite and diorite of Oak Hill, near San Jose, ibid. p. 390.

Sonoma County: **1**, Sphene is a conspicuous constituent of glaucophane schists near the mouth of the Russian River, Pabst (1) p. 333. **2**, Crystals up to 1 centimeter in size, often concentrated along crevices in eclogite, have been found at the W. P. A. quarry, Mill Creek, Switzer (5) p. 83.

Trinity County: **1**, It was found with epidote, colorless garnet, and zircon in a soda granite-porphyry in the Iron Mountain district, Weaverville quadrangle, (N. R.).

SPINEL

Magnesium, aluminum oxide, $MgO \cdot Al_2O_3$

Isometric. Usually in octahedrons; rounded grains. Brittle. Vitreous luster. Color ruby red, blue, green, brown, black. Streak white. H. = 8. G. = 3.5-4.1.

Infusible. Fused with sodium carbonate, dissolved in hydrochloric acid, the solution yields aluminum hydroxide on the addition of ammonia, and white magnesium phosphate on the further addition of sodium phosphate, thus distinguishing it from corundum.

Picotite is a brown spinel containing chromium and iron; it occurs in the serpentine rocks. *Pleonaste* is a dark-green iron-magnesium spinel.

Spinel occurs only as a rock constituent and exists in some of the gold-placer sands as ruby-red grains resembling red garnet.

Butte County: **1**, Small crystals of ruby spinel have been found in the rock of the "diamond mine" near Oroville, (N. R.).

Fresno County: **1**, Colorless, red, and black crystals 1 to 4 millimeters in diameter are present in the contact metamorphosed limestone of the Twin Lakes area, Chesterman (1) p. 254.

Humboldt County: **1**, Ruby spinel occurs in the beach sands at Gold Bluff, Kunz (24) p. 47.

Inyo County: **1**, Spinel, variety pleonaste, has been found in the south end of Butte Valley, Ubehebe (?) mining district, S.M.B. (21329).

Lassen County: **1**, Microscopic brown octahedral crystals of picotite have been found in quartz basalt at Cinder Cone, Lassen Volcanic National Park, Diller (3) p. 23, Finch and Anderson (1) p. 261.

Monterey County: **1**, Grains of ruby spinel have been found near Jolon, S. M. B. (15855).

Placer County: **1**, Picotite has been found at Rocklin, Hanks (12) p. 309, Schrader et al. (1) p. 75.

Riverside County: **1**, Specimens of spinel have come from northwest of Anza, and in the Thomas Mountain district, W. W. Bradley (29) p. 107. **2**, Spinel, both pale and dark blue green, has been found in minor amount at Crestmore, A. F. Rogers (31) p. 466, W. W. Bradley (28) p. 498, Murdoch (p. c., '45). **3**, Spinel has come from the old city quarry, Riverside, A. F. Rogers (19) p. 581. **4**, From the new city quarry, south of Riverside, Richmond (1) p. 725.

San Benito County: **1**, Pale crystals and grains of spinel have been found in altered serpentine half a mile downstream from the benitoite locality, Woodhouse (p.c., '45), Williams (p.c., '49), Watters (p.c., '51).

San Bernardino County: **1**, Black spinel occurs in the basalt flows south of Pipes Canyon, (secs. 21, 22, T. 1 N., R. 4 E., S. B.), (N. R.). **2**, In basalt near Quail Springs (T. 1 S., R. 7 E., S. B.), (N. R.). **3**, Black granular masses and small crystals of spinel have been found at the Dewey mine, Clark Mountain district, Schaller (50) p. 816.

San Diego County: **1**, Blue spinel was reported to occur in the Mack mine near Rincon; the deep-green, pleonaste variety, in small octahedrons, occurs there with garnet, Kunz (24) p. 48, A. F. Rogers (4) p. 209. **2**, Small rounded patches of bright green spinel (var. gahnite) occur in nodules of phosphate minerals from the Katerina mine, Hiriart Hill, Pala, Jahns and Wright (5) p. 31, Murdoch (p.c. '51).

San Luis Obispo County: **1**, Ruby spinel has been observed near San Luis Obispo, Kunz (1) p. 486, (24) p. 47; some of the crystals were half a carat each, and of gem quality.

Siskiyou County: **1**, Picotite occurs in the basalts of Mount Shasta, Wadsworth (1) p. 314, Hanks (12) p. 309.

Tulare County: **1**, Granular green spinel occurs in metamorphosed serpentine on the southwest side of Rocky Hill and in metamorphosed basic volcanic rocks on the southern slope of Woodlake Mountain, Durrell (p. c., '35).

SPODUMENE

Lithium and aluminum silicate, $LiAl(SiO_3)_2$

Monoclinic. Crystals prismatic, often flattened; sometimes very large. Massive, cleavage perfect prismatic. Brittle. Vitreous luster. Color greenish white, grayish white, emerald green, lilac, amethystine. Streak white. H. = 6½-7. G = 3.13-3.20.

Fuses to a clear glass and gives a red lithium flame, best seen through blue glass or through a Merwin color screen. Insoluble in acids.

Kunzite is a beautiful transparent variety, lilac or amethystine in color. It is sometimes called *California iris. Hiddenite* is an emerald-green spodumene. *Triphane* is colorless to yellow.

Spodumene is found in large crystals and cleavage masses in pegmatites, commonly associated with lepidolite and lithium tourmaline.

Kern County: **1**, Grains of spodumene have been identified in the heavy minerals from drill cores in the Lazard area, west of Lost Hills, Reed and Bailey (4) p. 363.

Riverside County: **1**, The variety kunzite has been found in the Fano [Simmons] mine (sec. 33, T. 6 S., R. 2 E., S. B.) on Cahuila Mountain, Kunz (23) p. 967, (24) p. 25. This kunzite shows spectroscopic traces of germanium, Papish (2) p. 477.

San Diego County: **1**, The variety kunzite was first discovered in the White Queen mine, Pala, in 1902, Kunz (26) p. 1345, and was described from the Pala Chief mine, Kunz (18) p. 264, (24) p. 83. The largest crystal found was 23 by 4 by 2 centimeters in dimensions. This kunzite showed 0.043 percent gallium by spectroscopic methods, Gabriel et al. (1) p. 119. Schaller (2) p. 265, has also recorded hiddenite and white spodumene from Pala. Other references, Baskerville (1) p. 303, Baskerville and Kunz (2) pp. 25-28, R. O. E. Davis (1) p. 29. Spodumene associated with lithia-beryl and purpurite (?) was found at the Naylor-Vanderberg mine, Pala, Kunz (26) p. 1344. Kunzite and hiddenite in crystals up to 7½ by 2 by 1½ inches in size are reported in the gem pegmatites at Pala, Jahns and Wright (5) pp. 19, 30, 36. **2**, Kunzite was found in small amounts at the Victor mine, Rincon, A. F. Rogers (4) p. 210. In the Clark vein, in the same locality, large rough crystals of spodumene occur in quartz, altering to petalite and heulandite, Murdoch (18) p. 198, Hanley (1) p. 23. **3**, Kunzite was found in the Mountain Lily mine, Aguanga Mountain, Kunz (24) pp. 25, 62. **4**, Small, clear pieces of spodumene have come from the Himalaya mine, Mesa Grande, Kunz (24) p. 135. **5**, An unverified report records kunzite from the Vista Chief and Mountain Belle mines, Moosa Canyon (E½ sec. 27, T. 10 S., R. 3 W., S. B.), Kunz (24) p. 62, F. J. H. Merrill (1) p. 702. **6**, Kunz (18) p. 280, has reported kunzite from near Menchoir.

SPURRITE

Calcium carbonate and silicate, $CaCO_3 \cdot 2Ca_2SiO_4$

Monoclinic. Granular masses. Cleavage, one good. Color pale gray to green and bluish. H. = 5. G. = 3.01.

Infusible. Gives calcium flame. Soluble in hydrochloric acid with some effervescence, and separation of silica.

Riverside County: **1**, Spurrite occurs intimately associated with merwinite and gehlenite in the limestone at Crestmore, Foshag (2) p. 80, Woodford (11) p. 360.

STANNITE

Sulfide of copper, iron, and tin, Cu_2FeSnS_4

Tetragonal, crystals rare. Massive granular. Poor cleavage. H. = 4. G. = 4.3-4.5. Luster metallic, streak blackish, color steel gray to iron black.

Decomposed by HNO_3 with separation of sulphur and tin oxide.

Santa Cruz County: **1**, Stannite occurs in crystalline limestone, associated with frankeite and meneghinite, in the Pacific Limestone Products quarry, 2 miles west of Santa Cruz, Milton, Chesterman (p.c. '54).

STAUROLITE

Iron aluminum silicate, $Fe''Al_4Si_2O_{10}(OH)_2$

Orthorhombic. Crystals, often cross twins. Cleavage, one distinct. Brittle. Subvitreous luster. Color yellow, brown, black. Streak uncolored. H. = 7-7½. G. = 3.65-3.77.

B.B. infusible. With the fluxes gives reactions for iron and manganese. Decomposed by sulphuric acid.

Staurolite occurs only in metamorphic rocks rich in aluminum.

Inyo County: **1**, Microscopic grains of staurolite have been found in quartz-mica schist on the west side of the Panamint Range near Ballarat, Murphy (4) p. 345.

STEATITE

See talc

STELLERITE

See stilbite

STEPHANITE—Brittle Silver Ore

Silver antimony sulphide, Ag_5SbS_4

Orthorhombic. Crystals common, showing at times striations on the prism faces; also massive. Brittle. Metallic luster. Color and streak iron black. H. = 2-2½. G. = 6.2-6.3.

The reactions are similar to those for pyrargyrite, but the streak or powder is black, whereas that of pyrargyrite is reddish.

Stephanite is an important and usually prominent silver mineral in silver districts, but it is not common in California. It is often associated with argentite and polybasite as an original mineral of the veins.

Alpine County: **1**, Stephanite has been reported from the Morning Star mine, Mogul district, Hanks (12) p. 371, Eakle (16) p. 13. Also with hübnerite from the Zaca mine, Gianella (1) p. 342, Partridge (1) p. 264.

Inyo County: **1**, It was found with argentite in the Cliff mine, northwest of the head of Deep Spring Valley, Goodyear (3) p. 237, **2**, It occurred with tetrahedrite and argentite at the Belmont mine, Cerro Gordo district, Tucker (4) p. 283.

Mono County: **1**, Stephanite occurred in the Benton district, Whiting (1) p. 378. **2**, It was abundant, with pyrargyrite, in the Oro, Addenda, and Fortuna mines, Bodie district, Whiting (1) p. 392. **3**, It is found in the Patterson district, Sweetwater Range, (N. R.).

Nevada County: **1**, It was found in the Allison Ranch mine, Grass Valley, Lindgren (12) p. 119.

San Bernardino County: **1**, It occurred in the St. Lawrence Rand mine (sec. 1, T. 30 S., R. 40 E., M. D.), Hamilton and Root (5) p. 170. **2**, In the Carlyle mine, Dale district (sec. 11, T. 1 S., R. 12 E., S. B.), Tucker and Sampson (27) p. 61.

Shasta County: **1**, It occurs with native silver, galena, and sphalerite in a calcite-quartz gangue at the Igo Consolidated mines, (N. R.).

STETEFELDTITE

See partzite

* STEWARTITE, 1912

Hydrous manganese phosphate, $3MnO \cdot P_2O_5 \cdot 4H_2O$

Triclinic. In fibers or minute crystals. One cleavage. Colorless to yellow. G. = 2.94.

Reacts similarly to hureaulite.

San Diego County: **1**, Stewartite was found as an abundant alteration product of lithiophilite in the Stewart mine at Pala. It was described and named by Schaller (29) p. 144.

STIBICONITE

Hydrous antimony oxide, $Sb_3O_6(OH)$?

Mostly amorphous. Massive or as a crust or powder. Color yellowish white. H. = 4-5½. G. = 5.1-5.28.

Reacts like cervantite, but yields water in a closed tube.

Occurs as an alteration product of stibnite or native antimony.

Inyo County: **1**, The bright- or orange-yellow alteration product of stibnite in Wild Rose Canyon may be stibiconite, D. E. White (1) p. 317. **2**, It has been doubtfully reported from Cerro Gordo, S. M. B. (8584).

Kern County: **1**, Stibiconite has been found with native antimony at Little Caliente Springs, S. M. B. (11671). **2**, On Erskine Creek, Behre (1) p. 332.

San Benito County: **1**, It has been reported from the Stayton mine, W. W. Bradley (28) p. 343.

San Bernardino County: **1**, An occurrence has been reported from the Old Woman Mountains, W. W. Bradley (28) p. 207.

San Luis Obispo County: **1**, It has been found with cervantite at the Marquart mine (T. 26 S., R. 9 E., M. D.), Eckel et al. (1) p. 537, 543.

* STIBIOFERRITE—Stibiaferrite, 1873

A hydrous antimony-iron oxide

Thin coatings. Color yellow to yellowish brown. H. = 4. G. = 3.6. Streak dull yellow. Luster slightly resinous. Soluble in HCl.

Santa Clara County: **1**, It has been found as a coating on stibnite at an unidentified location in the county, Goldsmith (3) p. 366.

STIBIOTANTALITE

Niobate and tantalate of antimony, $Sb(Ta,Cb)O_4$

Orthorhombic. Hemimorphic prisms, twinned. Cleavage, one distinct. Resinous to adamantine luster. Color light brown to dark brown. H. = 5½. G. = 5.98-7.37, mostly 6.6-6.7. Pyroelectric.

Reduced on charcoal with sodium carbonate, it gives a white coating and metallic brittle bead of antimony. Fused with potassium bisulphate, fusion dissolved in hydrochloric acid, and the solution boiled down with metallic tin, assumes the blue color due to niobium and tantalum.

San Diego County: **1**, Stibiotantalite was found in small amounts in the pegmatite veins at Mesa Grande associated with gem tourmaline, pink beryl, quartz, orthoclase, lepidolite, and cassiterite. It was described and analyzed by Penfield and Ford (8) p. 61. It was noted by Schaller (25) p. 352. Ungemach (1) p. 92 observes that it is not isomorphous with columbite. **2**, Stibiotantalite is very rare, but present in the pegmatites of Hiriart Hill, Pala, Jahns and Wright (5) p. 31.

STIBNITE—Antimonite

Antimony sulphide, Sb_2S_3

Orthorhombic. Long prismatic crystals, often bent and curved and with faces striated and furrowed. Cleavage, one perfect. Metallic luster. Color and streak lead gray. H. = 2. G. = 4.52-4.62.

Melts in a candle flame. Heated on charcoal, it gives dense white coating and odor of sulphur. Soluble in hydrochloric acid.

Stibnite is the common ore of antimony, and numerous deposits of it exist in the state. It occurs generally as veins in granitic rocks and schists. In gold and copper districts it is a common associate of galena, sphalerite, chalcopyrite, pyrite, and tetrahedrite. It is characteristically associated with cinnabar.

Alameda County: **1**, Large masses of stibnite occur at Mount Oso, in the Mount Diablo Range, J. B. Trask (2) p. 94, (4) p. 390.

Alpine County: **1**, It occurs with pyrargyrite and proustite at the Exchequer mine, Silver Mountain, R. W. Raymond (9) p. 22.

Calaveras County: **1**, Stibnite has been observed with gold at Mokelumne Hill, (N. R.). **2**, With cinnabar at the Oro y Plata mine near Murphy, Turner and Ransome (18) p. 6.

Colusa County: **1**, Stibnite occurs with cinnabar and gold at the Manzanita mine, Becker (4) p. 367.

Contra Costa County: **1**, Stibnite occurs at the Mount Diablo quicksilver mine, (N. R.).

Inyo County: **1**, In the Cerro Gordo district stibnite was found with the silver-lead ores, and some limonite specimens from there seem to be pseudomorphs after long prismatic stibnite crystals, (N. R.). **2**, Large bodies of stibnite with cervantite are said to occur on the western slope of the Panamint Range near Wild Rose Springs, Crawford (1) p. 21. **3**, A large outcrop occurs on the eastern slope of the Argus Mountains, between Revenue and Shepherd Canyons, C. A. Waring and Huguenin (2) p. 60. **4**, Blades of stibnite up to 4 inches in length, partly oxidized to cervantite, are found in the Darwin district, Kelley (4) p. 544. **5**, It has been mined 4½ miles south of Bishop, Tucker and Sampson (32) p. 58. **6**, Stibnite occurs as lenses and pods in limestone at the Old Dependable antimony mine, NE¼ T. 19 S., R. 45 E., M. D., Norman and Stewart (2) p. 29. **7**, Also at the Rocket claim, sec. 29, T. 22 S., R. 43 E., M. D., ibid. p. 84.

Kern County: **1**, The deposits of stibnite in the San Emigdio Mountains at the head of San Emigdio Canyon (sec. 10, T. 9 N., R. 21 W., S. B.) have long been known and were the first worked in the state, W. P. Blake (7) p. 292, Angel (2) p. 225. Veins of stibnite are plentiful in the mountains in the northeastern part of the county. **2**, On Erskine Creek stibnite has been found with native antimony, W. W. Bradley (11) pp. 21, 22. **3**, Stibnite also occurs in the Caliente district,

Boalich and Castello (2) p. 11. **4,** Good crystalline stibnite occurs at Piute (N. R.). **5,** In the Tom Moore mine, Clear Creek district, W. W. Bradley (11) pp. 21, 22. **6,** Near Tehachapi, W. W. Bradley (11) p. 21. **7,** Near Kernville, Hanks (12) p. 375. **8,** At Hot Springs. **9,** Near Havilah, Watts (2) p. 237. **10,** In the Cedar Creek mining district (N. R.). **11,** It occurs in the Sierra Sue mine near Glennville (N. R.). **12,** Minute spherulites of stibnite occur in kernite and borax in the Kramer district, Schaller (45) p. 165. **13,** 30 miles west of Koehn [Cane] (secs. 5, 6, T. 30 S., R. 31 E., M. D.), G. C. Brown (1) p. 476. **14,** Near Amalie (sec. 34, T. 30 S., R. 32 E., M. D.), Tucker and Sampson (32) p. 61. **15,** Rarely in Golden Queen mine, near Mojave, J. W. Bradley (p. c., '45).

Lake County: **1,** Stibnite has been found with cinnabar at Sulphur Bank on Clear Lake, W. P. Blake (29) p. 642. It is being deposited now, C. P. Ross (3) p. 339, (5) p. 451, Everhart (1) p. 139.

Los Angeles County: **1,** Stibnite has been found in the mountains south of Lancaster, Aubury (3) p. 359. **2,** In Pacoima Canyon, with cobalt-nickel ores, Tucker (13) p. 288.

Merced County: **1,** Fine specimens of prismatic stibnite have come from the McLeoud mining district (sec. 32, T. 11 S., R. 7 E., M. D.), Laizure (3) p. 175; **2,** from the Red Metal mine (sec. 32, T. 11 S., R. 7 E., M. D.), Irelan (3) p. 350.

Mono County: **1,** Stibnite is common in the Blind Spring Hill district, associated with the silver-lead ores, and good specimens have come from the Comanche, Comet, and Diana mines, Loew (1) p. 653. **2,** Stibnite occurs in Bloody Canyon (T. 1 S., R. 25 E., M. D.), Hanks (12) p. 375.

Monterey County: **1,** Stibnite occurs at Los Burros mines (sec. 1, T. 24 S., R. 5 E., M. D.), Preston (4) p. 261.

Napa County: **1,** Fibrous bands of stibnite occurred with the cinnabar at the Manhattan and the Boston or old Redington mines at Knoxville, W. W. Bradley (5) p. 86.

Nevada County: **1,** Stibnite occurs with galena in quartz at the Red Ledge mine, E. M. Boyle (1) p. 67. **2,** In the Mohawk antimony mine near Nevada City, ibid. pp. 13, 67.

Orange County: **1,** It occurs with galena and sphalerite in the Dunlap mine, head of Santiago Canyon, Hanks (14) p. 119.

Placer County: **1,** It occurs with gold-bearing quartz in the St. Laurence mine, Ophir mining district, C. A. Waring (4) p. 350.

Riverside County: **1,** Bunches of stibnite were found at the Crowell mine, 5 miles southeast of South Riverside, (N. R.). **2,** Fine-grained stibnite was found near Corona, F. J. H. Merrill (2) p. 524. **3,** Stibnite occurs in Mabey Canyon, Tucker and Sampson (32) p. 65.

San Benito County: **1,** There are numerous veins of stibnite in association with the cinnabar deposits, especially in the northeastern part of the county. Fine crystallized specimens have come from the Rip Van Winkle, Alta, Gleason, and Shriver claims on Antimony Peak, northeast of Hollister, Hanks (12) p. 374, Crawford (1) p. 22. Some of the good crystals were measured by Eakle (9) p. 231. **2,** Long divergent prisms of stibnite have come from the Blue Wing vein of the Stayton quicksilver mine, Aubury (2) p. 148.

San Bernardino County: **1**, Stibnite was found in a boulder at the Centennial mine, Hanks (12) p. 375, De Groot (1) p. 461. **2**, A small vein of stibnite associated with wolframite was found in Clark Mountain, Hess (14) p. 49, Tucker and Sampson (16) p. 204. **3**, It occurred with the scheelite at Atolia, Hess (14) p. 49, Lemmon and Dorr (4) p. 219, and in large crystals in the silver ores of the Rand district, Hulin (1) p. 99. **4**, Stibnite is present with wolframite at the Sagamore mine, New York Mountains, Aubury (4) p. 332. **5**, It is found occasionally at the Calico mines with realgar, Weeks (2) p. 768. **6**, Stibnite is reported from the Desert Antimony Mine, sec. 18, T. 16 N., R. 14 E., S. B., 2½ miles east of Mountain Pass, L. A. Wright et al. (5) p. 60.

San Luis Obispo County: **1**, It occurs near the head of the San Simeon Creek, Logan (3) p. 676. **2**, Radiating prisms of stibnite in quartz occur near Cambria, S. M. B. (13827). 3, Beautiful crystalline stibnite with pyrite in quartz occurs on the South Fork of San Simeon Creek, near the summit of the Santa Lucia Range, (N. R.).

Santa Clara County: **1**, Large divergent columnar masses have come from near Gilroy, Hanks (12) p. 375. **2**, Stibnite is an associate of cinnabar at the New Almaden quicksilver mines (Stanford Collection). **3**, It occurs at Pacheco Pass, Hanks (12) p. 375.

Sierra County: **1**, It occurs with the gold ores at Downieville, S. M. B. (7101).

Trinity County: **1**, It is found near T. 38 N., R. 6 W., M. D., W. P. Miller (1) p. 716.

Tulare County: **1**, It is found in the Mineral King district as an associate of argentiferous galena in quartz with pyrite on the Dennison Mountains; in a quartz vein cutting slate at the Lady Alice mine, a quarter of a mile south of Mineral King, Hanks (12) p. 375, Franke (1) p. 431.

STILBITE

Hydrous sodium, calcium, and aluminum silicate, $(Ca,Na,K)_6Al_{10}(Al,Si)_2Si_{28}O_{80} \cdot 30H_2O$

Monoclinic. Commonly in sheaf-like aggregates, lamellar. Cleavage, one perfect. Brittle. Vitreous to pearly luster. Color white, yellowish brown. Streak uncolored. H. = 3½-4. G. = 2.09-2.20.

Fuses with exfoliation. Gives water in a closed tube. Soluble in hydrochloric acid without gelatinizing.

Stellerite and *epidesmine* are varietal names of certain types of stilbite.

Stilbite is a common zeolite occurring usually as sheaflike aggregates in cavities and seams of volcanic rock.

Inyo County: **1**, Stilbite crystals occur in platy calcite from the Cardinal mine, Middle Fork, Bishop Creek, Murdoch (p. c. '51).

Los Angeles County: **1**, Stilbite occurs with heulandite, as sheaves and platy crystals up to 8 centimeters long, a quarter of a mile west of Acton, Murdoch and Webb (6) p. 352. **2**, Sheaflike aggregates of tabular crystals occur at locality 6, Coldwater Canyon, Neuerburg (1) p. 158. **3**, Stilbite is very widespread on fractures in dioritic rocks in the region of the Vincent cutoff, Neuerburg (p. c. '53).

Modoc County: **1**, Specimens of lava with amygdules filled with stilbite and natrolite have come from this county, S. M. B. (10258).

Plumas County: **1**, White and brown stilbite occur with chabazite and natrolite in the cavities of basic rock at Engels, A. Knopf and An-

derson (12) p. 30. **2**, Stilbite occurs as coatings or sheaves, in veins with apatite, south of and near the Superior mine, C. A. Anderson (6) p. 313.

Riverside County: **1**, Translucent stilbite occurs with phillipsite in garnet rock at Crestmore, Woodford et al. (10) pp. 362, 374.

San Bernardino County: **1**, Tabular crystals in lava cavities occur on Opal Mountain, T. 32 S., R. 45 E., M. D., Lackey (p. c., '43).

San Diego County: **1**, It occurs as sheaflike aggregates of small brown crystals at the Victor mine near Rincon, A. F. Rogers (4) p. 213. **2**, Occasionally in some of the gem-bearing pegmatites at Pala, Schaller (p. c., '35), Jahns and Wright (5) p. 42. **3**, Stellerite, which according to Pabst (5) p. 271 is the same as stilbite, has been found in cavities of the igneous rock at the Calavera quarry, Larsen and Switzer (16) p. 567. **4**, Stellerite has been recorded as abundant in irregular veins in a quartz latite stock at the head of the south fork of San Onofre Creek, Larsen (17) p. 111. **5**, Stilbite is found in veins in granodiorite boulders in Fish Creek wash, 2 or 3 miles south of the Fish Creek Mountains gypsum deposit, J. Murdoch (p.c. '48).

Santa Barbara County: **1**, It was found in the San Pablo Mountains of Santa Rosa Island, S. M. B. (12295).

Sonoma County: **1**, Stellerite is reported from near the Devils Pulpit, The Geysers, on the ridge above the bluff, Vonsen (6) p. 292.

Tulare County: **1**, It occurs in volcanic rock at Mount Kaweah, (N. R.).

STILPNOMELANE

Hydrous iron, magnesium, and aluminum silicate
$2(Fe,Mg)O \cdot (Fe,Al)_2O_3 \cdot 5SiO_2 \cdot 3H_2O$

Monoclinic. Micaceous. Brassy to submetallic luster. Color black, yellowish and greenish bronze. H. = 3-4. G. = 2.77-2.96.

Fuses with difficulty and becomes magnetic. Decomposed by hydrochloric acid, but without forming a jelly. Gives much water in a closed tube.

Chalcodite is a rare brown variety, occurring in minute scales, often with a bronze luster.

Inyo County: **1**, Stilpnomelane has been reported to occur as bronze-brown flakes on analcite and natrolite in the amygdules of an andesite in the Furnace Creek wash, 2 miles west of Ryan. Foshag (p. c., '47), however, thinks its identity is quite doubtful, and suggests celadonite or chlorite.

Santa Barbara County: **1**, Brown crystals of chalcodite have come from this county, S. M. B. (11533).

Santa Clara County: **1**, Stilpnomelane has been reported in some of the glaucophane schists of the New Almaden region, Hutton (1) p. 1373.

STOLZITE

Lead tungstate, $PbWO_4$

Tetragonal. In pyramidal crystals. H. = 3. G. = 7.8-8.1. Color green to gray to brown. Easily fusible.

Inyo County: **1**, Bunches of crystals of stolzite, coated with tungstite, were found in the Thompson mine at Darwin, Tucker and Sampson (30) p. 567, S. M. B. (21074).

STREAM TIN

See cassiterite

STRENGITE

Hydrous iron phosphate, $FePO_4 \cdot 2H_2O$

Orthorhombic. Generally in spherical and botryoidal forms. One cleavage perfect. Vitreous luster. Color pale red. H. = 3-4. G. = 2.87.

Fusible. Soluble in hydrochloric acid.

Occurrences may be metastrengite, which see.

Amador County: **1**, Strengite was described by Hulin (3) p. 351 as occurring with apatite in the deep levels of the Kennedy mine.

San Diego County: **1**, Blue fibrous strengite (?) occurred with salmonsite in the Stewart mine at Pala, Schaller (29) p. 145.

STROMEYERITE

Silver and copper sulphide, $(Ag,Cu)_2S$

Orthorhombic. Generally compact massive. Metallic luster. Color and streak dark steel gray. H. = 2-2½. G. = 6.15-6.3.

Dissolves in nitric acid; a few drops of hydrochloric acid added to the solution produce a precipitate of white silver chloride. Ammonia added to solution dissolves this precipitate and the solution turns deep blue.

Alpine County: **1**, Stromeyerite was observed in the Monitor mining district, Crawford (1) p. 373, Eakle (16) p. 13.

El Dorado County: **1**, Stromeyerite was tentatively identified in the Winton and Threlkil prospect (SE¼ sec. 17, T. 11 N., R. 8 E., M. D.), Logan (19) p. 225.

Inyo County: **1**, The Silver Queen and other mines of the Panamint Range contained stromeyerite associated with tetrahedrite and cerargyrite. It was found: **2**, in the Cerro Gordo, Irelan (4) p. 47, and **3**, Wild Rose districts, Crawford (1) pp. 373, 374. **4**, It was found in the White Mountains and the Inyo Range, at various places, according to Aaron, Hanks (12) p. 375.

Mono County: **1**, It occurs with tetrahedrite in the silver ores of the Blind Spring Hill district, where it is the principal secondary silver mineral, Fairbanks (15) p. 151, R. J. Sampson (14) p. 172.

Riverside County: **1**, "Copper-silver glance," perhaps stromeyerite, was found at the Homestake group 8 miles northwest of McCoy Springs, Palen Mountains, Aubury (1) p. 257.

San Bernardino County: **1**, Stromeyerite occurred as one of the numerous minerals of the Calico district and an analysis of it from the Silver King mine was made by Melville and Lindgren (1) p. 27. **2**, It occurred with cerargyrite and oxidized ores in the Clarke Mountains, G. M. Wheeler (3) p. 53.

Sierra County: **1**, A specimen of stromeyerite came from the Original 16-1 mine, Alleghany, (N. R.).

STRONTIANITE

Strontium carbonate, $SrCO_3$

Orthorhombic. Crystals acicular. Columnar masses, fibrous, granular. Cleavage prismatic. Vitreous luster. Color white, gray, pale green, and yellowish brown. Streak white. H. = 3½-4. G. = 3.68-3.71.

Effervesces in acid like calcite. Distinguished from calcite by its permanent deep-crimson flame obtained by taking a little of the powder on a platinum wire moistened with hydrochloric acid and holding it in a colorless Bunsen flame.

Inyo County: **1**, A deposit of brown massive strontianite occurs 3 miles west of Shoshone, S. M. B. (19440-D).

Plumas County: **1**, Large masses of divergent columnar strontianite were found in the Genessee Valley, S. M. B. (15350).

Riverside County: **1**, Strontianite occurs sparsely as white tufted fibers in minute balls, on a joint surface of rock in the Lone Star quarry at Crestmore, Woodford et al. (10) p. 374.

San Bernardino County: **1**, Large deposits of strontianite occur as brown fibrous and gray granular masses in limestone in the Mud Hills, (Strontium Hills), (secs. 20, 30, T. 11 N., R. 1, 2 W., S. B.), 10 miles north of Barstow, A. Knopf (9) p. 257, B. N. Moore (1) p. 376, Durrell (8), p. 23. Celestite and gypsum are associated in this deposit. It also occurs here in fan-shaped or spherical aggregates up to 3 inches in size, in clay beds. **2**, It is relatively common as yellow-brown drusy coatings lining cavities in limestone which carry celestite and colemanite, at Borate in the Calico Hills, Murdoch (p. c., '45). This is probably the same material mentioned by Silliman (12) p. 130, as aragonite, presumably from Calico. **3**, A small deposit is found also in the Calico Hills about halfway down hill on the road from Borate to Yermo, Murdoch (p. c., '45).

San Diego County: **1**, Strontianite is reported from the Lost Canyon mine 5 miles northwest of Jacumba, Tucker and Reed (26) p. 52.

STRÜVERITE

See rutile

STYLOTYPITE

See tetrahedrite

* SULPHOHALITE, 1888

$2Na_2SO_4 \cdot NaCl \cdot NaF$

Isometric. Crystals, mostly octahedrons; rarely dodecahedrons and cubes. Vitreous luster. Color faint greenish yellow. H. = 3½. G. = 2.43.

Fuses with intumescence, coloring the flame yellow. Soluble in water, and barium chloride precipitates barium sulphate. Silver nitrate precipitates silver chloride.

San Bernardino County: **1**, Sulphohalite was first discovered in 1888, as small crystals implanted on hanksite at Searles Lake, and was described and named by Hidden and MacKintosh (2) p. 464. It was analyzed by Penfield (5) p. 425, and by Hicks, H. S. Gale and Hicks (7) p. 273.

	SO_3	Na_2O	K_2O	Na	Cl	F	Ign
Penfield	41.79	32.37	0.10	11.60	9.10	4.71	0.15 = 99.82%
Hicks	42.00	32.50	--	11.35	9.19	[4.17]	0.25

The crystals are cubo-octahedrons, Foshag (21) p. 51, or occasionally simple octahedrons, H. S. Gale and Hicks (7) p. 273. Additional references, H. S. Gale (13) p. 307, Foshag (4) p. 76.

SULPHUR

Native sulphur, S

Orthorhombic. Pyramidal and thick tabular crystals. Also massive, incrusting, and powder. Brittle, resinous. Yellow, brownish or greenish yellow. Streak white. H. = $1\frac{1}{2}$-$2\frac{1}{2}$. G. = 2.05-2.09.

Burns with a bluish flame. Insoluble in water. Readily distinguished by color, fusibility, and combustibility.

Yellow sulphur is common in the vicinity of geysers, hot springs and volcanoes. It is also found in gypsum beds, and in association with borax.

Alpine County: **1**, Sulphur occurs in brecciated tuff and is commercially produced at the Leviathan mine, Leviathan Peak district, 7 miles east of Markleeville, W. W. Bradley (21) p. 183, Gary (1) p. 495, Pabst (6) p. 425.

Colusa County: **1**, On the banks of Sulphur Creek solfataric action has produced fine crystallized masses and granular coatings of sulphur, sometimes in association with cinnabar, Fairbanks (6) p. 121. **2**, Good specimens have come from the Manzanita mine, W. W. Bradley (19) p. 196, and **3**, the Elgin mine, Goodyear (4) pp. 157, 159, Fairbanks (6) p. 121, W. W. Bradley (10) p. 678; the latter mine also produced small commercial output of sulphur.

Imperial County: **1**, The solfataric vents near Niland have rims of sulphur crystals and salt. They have been described by Hanks (9) p. 231. **2**, A small sulphur deposit occurs on the eastern slope of Coyote Mountain (SE$\frac{1}{4}$ sec. 6, T. 16 S., R. 10 E., S. B.), F. J. H. Merrill (1) p. 741, Tucker (11) p. 284. **3**, Another is 8 miles north of Iris siding on the Southern Pacific Railroad, Tucker (11) p. 285. **4**, It is found with claudetite and realgar 6 miles north of the 4S Ranch, Kelley (1) p. 137.

Inyo County: **1**, A deposit of sulphur occurs at Sulphur Bank on Owens Lake, near Olancha, Loew (1) p. 652. **2**, Sulphur has been found with fluorite and gypsum in the Defiance mine, Darwin, S. M. B. (7601). **3**, Sulphur deposited by solfataric action occurs in an area of several acres, 9 miles east of Coso Junction, Loew (3) p. 195, Tucker (11) p. 523. **4**, A small deposit of sulphur is reported in the mountains east of Big Pine, Tucker and Sampson (25) p. 487, Lynton (1) p. 575. **5**, A number of deposits of sulphur in limestone occur in the Last Chance Range, (sec. 15, T. 9 S., R. 34 E., M. D.), Tucker (4) p. 300.

Kern County: **1**, On both sides of the San Joaquin Valley impure beds of gypsum and limestone occur, having considerable sulphur intermixed, Watts (2) p. 233. **2**, Sulphur occurs with alum in the Sunset district, Watts (3) p. 33.

Lake County: **1**, An interesting deposit of sulphur at the Sulphur Bank quicksilver mine on Clear Lake was described by J. Le Conte and Rising (1) p. 26 and by Becker (4) p. 255. The black basaltic rock which outcrops on the lake has been bleached white and altered to a porous mass of silica by the action of fumes coming from several vents. Brilliant crystals of sulphur and acicular crystals of cinnabar have formed in the pores and cavities of this altered mass of rock. Stalactites of sulphur were found in crevices, J. A. Phillips (1) p. 422. Sulphur was obtained in considerable quantity commercially from this deposit before it was found to overlie a richer deposit of cinnabar. **2**, Sulphur also occurred with borax at Little Borax Lake, just south of Clear Lake, (N. R.).

Mariposa County: **1**, Crystals of sulphur have been found with cinnabar on Horseshoe Bend Mountain, near Coulterville, (N. R.).

Mono County: **1**, It occasionally occurs in large balls filling cavities in the andalusite ore at the mine of Champion Sillimanite, Incorporated, on the western slope of the White Mountains, 7 miles east of Mocalno, Melhase (1) p. 92, R. J. Sampson and Tucker (4) p. 461.

Monterey County: **1**, Sulphur occurs with cinnabar in pockets in sandstone at the Parkfield mine (sec. 35, T. 22 S., R. 14 E., M. D.), Aubury (2) p. 123. **2**, "Large mines or beds" of sulphur were reported in 1847, 25 miles north of Monterey, by Sloat (1) p. 366.

San Bernardino County: **1**, It occurs at Searles Lake as one of the many minerals associated with borax, Pratt (1) p. 124. **2**, Sulphur occurs in lenticular masses of mixed sulphates in the Calico Hills, at the "sulphur hole," Borate, Foshag (19) p. 352.

Santa Barbara County: **1**, Sulphur crystals occur at Point Rincon, and on the north side of Graciosa Ridge, south of the Santa Maria Valley, at openings caused by the escape of gases from burnt shales, Martinez (1) p. 39, Duflot de Mofras (1) p. 196, Antisell (1) p. 67, H. C. Ford (1) p. 53, Arnold (2) p. 13, Arnold and Anderson (3) p. 751. **2**, Free sulphur is found in sediments of the Channel Islands, P. D. Trask and Wu (3) p. 89. **3**, Sulphur deposits are reported in the Azur Mountains, D. T. Day (2) p. 864.

Shasta County: **1**, It occurs in the gossans of the copper belt, L. C. Raymond (1) p. 414. **2**, At Bumpass Hell and Supan Springs in Lassen Volcanic National Park, A. L. Day and Allen (1) p. 120.

Siskiyou County: **1**, Crystals of sulphur and gypsum are abundant at the spring near the summit of Mount Shasta, H. Williams (2) p. 240.

Sonoma County: **1**, Sulphur is found at The Geysers, Laizure (4) p. 365. **2**, As early as 1847, pure masses of sulphur weighing as much as 1 pound were found near the town of Sonoma, Sloat (1) p. 366.

Ventura County: **1**, Deposits of sulphur occur in Sulphur Mountain 3 miles east of Fillmore, S. M. B. (14592).

Yolo County: **1**, Sulphur occurs with cinnabar in decomposed serpentine at the New England mine (sec. 26, T. 12 N., R. 5 W., M. D.), Aubury (2) p. 117.

SYLVANITE—Graphic Tellurium

Telluride of gold and silver, $(Au,Ag)Te_2$

Monoclinic. Bladed crystals and massive. Cleavage, one perfect. Metallic luster. Color silver white to yellow. Streak silver gray. H. = 1½-2. G. = 7.9-8.3.

The tellurium is easily driven off as an oxide by heat, leaving a button of gold and silver. Gives a deep-violet solution when boiled with concentrated sulphuric acid. The silver can be extracted from the button by nitric acid and precipitated as silver chloride by hydrochloric acid.

Though sylvanite may be present in many of the gold districts where tellurium is found, it has been identified in but few localities in California.

Calaveras County: **1**, Sylvanite was one of the tellurides occurring in the Carson Hill mines and was especially prominent in the Melones and Stanislaus mines, and also occurred in the Morgan mine, Silliman (9) p. 378, J. R. Browne (4) p. 62, Hanks (12) pp. 384, 388. An analysis of sylvanite from the Stanislaus mine was made by Mathewson (1) p. 274.

Trinity County: **1**, Sylvanite has been found with gold in the Yellow Jacket mine (N. R.). **2**, With nagyagite at the Dorleska mine, Coffee Creek district, Stines (1) p. 25. **3**, In the Gold Jubilee mine, 5 miles northwest of Carrville, Averill (3) p. 39. **4**, At the Yellow Aster mine, with petzite. Mining and Scientific Press (34) p. 473.

Tuolumne County: **1**, It occurs with petzite in the the Sugarman and Nigger mine, 2 miles north of Sonora, (sec. 30, T. 2 N., R. 15 E., M. D.) Logan (23) p. 72. **2**, Brilliant crystalline plates of sylvanite have come from the Rawhide Rancho near Junction, Silliman (9) p. 378, and **3**, the Golden Rule mine, ibid.

Yuba County: **1**, It occurs with the gold in the Red Ravine mine, Dobbins district (sec. 30, T. 18 N., R. 7 E., M. D.), C. A. Waring (4) p. 453.

SZAIBELYITE

Hydrous magnesium borate, $2MgO \cdot B_2O_3 \cdot H_2O$

Orthorhombic. Fibrous. White. H. less than 3. G. = 2.6.
Readily fusible. Soluble in acids.

Marin County: **1**, Szaibelyite occurs as impregnations and coatings on serpentine near Stinson Beach. It was first observed and analyzed by Eakle (24) p. 100, who considered it to be camsellite. Schaller (44) p. 230, suggested the identity of camsellite and szaibelyite, and Watanabe (1) p. 454, has reported the identity of camsellite from California, with szaibelyite from Leopoldshall, Germany. Schaller (53) p. 470, has shown definitely that szaibelyite = (ascharite, camsellite, β-ascharite).

SZOMOLNOKITE—Ferro-pallidite

$FeSO_4 \cdot H_2O$

Monoclinic. Crystals are pyramidal. G. = 3.08. Color yellow or brown.

Trinity County: **1**, Brown pyramidal crystals of szomolnokite have been found at the Island Mountain copper deposit, Foshag (p. c., '46).

TALC

Hydrous magnesium silicate, $Mg_3Si_4O_{10}(OH)_2$

Monoclinic. Foliated massive to granular and compact massive. Cleavage basal, perfect. Sectile. Pearly luster. Color white, pale green, apple green, gray, brown. Streak white. Feels greasy. H. = 1-1½. G. = 2.7-2.8.
Infusible. Insoluble in acid. Gives water in closed tube on intense ignition.
Soapstone (steatite) is a compact to coarse granular, grayish-green to brownish-gray variety.

Talc is common in the metamorphic rocks of the state, forming talc schists. It occurs as a hydration product in the alteration of magnesian silicates, and is often associated with serpentine and with actinolite. Only the more important occurrences can be described in detail. References will be given to others. Hanks (12) p. 385, gives a list of talc specimens in the State Division of Mines Exhibit.

Alameda County: **1**, Talc pseudomorphs after actinolite occur on Apperson Creek, southeast of Sunol, A. F. Rogers (3) p. 19.

Amador County: **1**, Pure steatite is abundant on the Van Dusen Ranch near Newtonville, Engineering and Mining Journal (4) p. 148.

El Dorado County: **1,** Good-quality steatite was worked for the first time in the county near Webber Creek (Darlington soapstone), J. R. Browne (4) p. 82, Logan (9) p. 45.

Imperial County: **1,** A selvage of talc occurs along the kyanite deposit of the Vitrefrax Corporation 4 miles northeast of Ogilby, Melhase (1) p. 94.

Inyo County: **1,** A number of valuable deposits of talc occur in this county, along the contact of limestones and intrusive rocks: Sierra and Acme Talc (secs. 32, 33, T. 18 S., R. 40 E., M. D.), Tucker (4) p. 300, R. J. Sampson (11) p. 269. **2,** Simonds, 17 miles southeast of Keeler, C. A. Waring and Huguenin (2) p. 126. **3,** Tramway, 3½ miles northwest of Keeler, Tucker (4) p. 301. **4,** 8 miles southwest of Zabriskie, Diller (13) p. 158. Detailed discussion of talc deposits of Inyo County is found in B. M. Page (1), Wright, L. A. (7).

Los Angeles County: **1,** A deposit of steatite on Santa Catalina island was used by the Indians to make soapstone kettles, etc., Schumacher (2) p. 117-121.

Madera County: **1,** Talc schists which can be sawed into blocks occur on the north side of San Joaquin River above Friant, R. P. McLaughlin and Bradley (3) p. 559.

San Bernardino County: **1,** A large deposit of crystalline talc occurs near Silver Lake (T. 17 N., R. 10 E., S. B.), Diller (13) p. 159, Tucker (4) p. 368. General discussion of occurrences in Wright, L. A. (6).

Shasta County: **1,** A good grade of white talc occurs 2½ miles north of Whiskeytown (secs. 5, 8, 15, T. 32 N., R. 6 W., M. D.), Logan (9) p. 210.

Sierra County: **1,** Blocks of soapstone for hoist foundations have been quarried at the Alaska mine near Pike City, Averill (11) p. 49.

References to other less important occurrences of talc, listed by counties, are: Amador, Tucker (1) p. 53; Butte, Stoddard (3) p. 162, L. L. Root (6) p. 210; Calaveras, Turner (4) p. 471; Tucker (1) p. 131; El Dorado, Logan (4) pp. 432, 433; Glenn, W. W. Bradley (1) p. 199; Inyo, Tucker and Sampson (25) pp. 492, 493, 495, Diller (13) p. 159; Los Angeles, Simpson (1) p. 414; Mariposa, Hanks (15) p. 137; Riverside, [with tremolite asbestos] F. J. H. Merrill (2) p. 552; San Bernardino, Tucker (4) p. 367, Tucker and Sampson (33) p. 131, E. Sampson (1) p. 98; Siskiyou, G. C. Brown (2) p. 871; Trinity, G. C. Brown (2) p. 924; Yuba, C. A. Waring (4) p. 458.

TANTALITE

See columbite

TARANAKITE—Minervite

Perhaps $K_2Al_6(PO_4)_6(OH)_2 \cdot 18H_2O$

Basic potassium-aluminum phosphate. Massive, claylike. Color white, gray, yellowish white. Very soft, unctuous to touch. G. = 2+. It is found as deposits in caves or along sea coasts, produced by reactions on bat or bird guano.

San Francisco County: **1,** Minervite, a phosphate not heretofore reported from California, occurs in a cave on the South Farallon Islands off the Golden Gate, Hanna (2) p. 308.

* TEEPLEITE, 1938

Hydrous sodium borate and chloride, $Na_2B_2O_4 \cdot 2NaCl \cdot 4H_2O$

Tetragonal. Tabular crystals. Colorless to light buff. Very brittle. No cleavage. H. = 3. G. = 2.076.

Fuses easily. Yields water in closed tube. Soluble in water.

Lake County: **1**, Teepleite occurs with trona and halite in Borax Lake, near Clear Lake. It was found and named by W. A. Gale and M. Vonsen, W. W. Bradley (26) p. 297, W. A. Gale et al. (1) p. 48. Analysis by Foshag ibid. (p. 50).

Na	K	Ca	Cl	B_2O_4	CO_3	SO_4	H_2O	insol.
28.93	--	0.08	18.72	22.05	9.42	--	20.48	0.15 = 99.83%

Calcium is as $CaCO_3$.

TELLURIUM

Native tellurium, Te

Hexagonal-rhombohedral. In prismatic crystals; commonly columnar to fine granular massive. Perfect prismatic cleavage. Luster metallic. Color and streak tin white. H. = 2-2½. G. = 6.2.

B.B. wholly volatile. Gives red solution in warm concentrated sulphuric acid.

Native tellurium is sometimes found in association with the tellurides of gold, silver, lead, and bismuth. It is occasionally found in the gold concentrates when not visible in the ore, and has been thus reported from some of the mining districts of the state.

Butte County: **1**, Tellurium was reported to have occurred in a cavity in a fragment of unrounded coarse gold washed from gravel, Turner (19) p. 424.

Calaveras County: **1**, Foliated masses of native tellurium with the gold tellurides occurred in the old Stanislaus mine and the Melones mine, Genth (5) p. 312, Silliman (9) p. 379, Küstel (2) p. 128. **2**, Foliated tellurium was reported to have been found in one of the mines at Angels Camp, Genth (5) p. 312, Silliman (9) p. 379.

Mariposa County: **1**, Tellurium has been found at the Josephine and Pine Tree mines at Mariposa, Silliman (9) p. 9.

Shasta County: **1**, Native tellurium was found in the Eureka mine, near Redding (N. R.).

Tuolumne County: **1**, Some native tellurium has been found associated with tellurides of gold and silver in the mines near Tuttletown and Jamestown, Silliman (9) p. 379, Hanks (12) p. 388, Turner (19) p. 427.

TENNANTITE

See tetrahedrite

TENORITE—Melaconite

Cupric oxide, CuO

Monoclinic. In minute scales; also as an earthy powder; massive. Metallic to dull luster. Color and streak black. H. = 3-4. G. = 5.82-6.5.

Same reactions as obtained from cuprite. Distinguished by color.

The massive material is frequently called *melaconite.*

Alpine County: **1**, Melaconite was reported by Conkling (1) p. 184, from the Monitor district; see also Aubury (1) p. 115.

Calaveras County: **1**, Tenorite is a common alteration product of chalcopyrite at Copperopolis, J. D. Whitney (7) p. 255. **2**, Campo Seco, Hanks (12) p. 260. **3**, Large nodular masses of it have come from the

Satellite mine (N. R.). **4,** It is found with malachite at the Telegraph mine, Hog Hill (N. R.).

Colusa County: **1,** Tenorite was found in serpentine with native copper and cuprite at the Gray Eagle mine (N. R.).

Del Norte County: **1,** It occurred with the chalcopyrite at the Alta and Pearl mines, Diamond Creek district, Aubury (1) p. 115.

El Dorado County: **1,** "Gray oxide" was found on the Bryant Ranch (sec. 2, T. 8 N., R. 9 E., M. D.), Aubury (1) p. 180.

Fresno County: **1,** It has been reported from Pine Flat, 10 miles east of Letcher, Crawford (2) p. 58.

Inyo County: **1,** It has been found in the Greenwater district on the east slope of the Black Mountains, C. A. Waring and Huguenin (2) p. 70.

Kern County: **1,** Tenorite was found with sulphides at the Greenback mine, Woody district, Storms (13) p. 635. **2,** It is reported from the San Emidio [Emigdio] Ranch, Hanks (12) p. 259.

Mariposa County: **1,** A large mass of melaconite was mined at the White Rock Copper King (sec. 14, T. 7 S., R. 17 E., M. D.), Aubury (1) p. 210. **2,** Considerable "black oxide" came from the Buchanan mine, Hunters Valley, J. R. Browne (4) p. 213.

Mendocino County: **1,** It occurs with sulphides and carbonates at the Redwood Copper Queen (secs. 17, 20, T. 12 N., R. 13 W., M. D.), Aubury (1) p. 137.

San Bernardino County: **1,** Melaconite has been found at several localities: Silver Mountain district, Old Dad Mountains, New York Mountains; Cloudman et al. (1) pp. 784, 790.

San Diego County: **1,** Some melaconite was found at the Barona copper mine (T. 14 S., R. 1 E., S. B.), Aubury (1) p. 260.

Shasta County: **1,** It has been recorded from the Afterthought mine, Hanks (12) p. 260.

TEPHROITE

Manganese silicate, Mn_2SiO_4

Orthorhombic. Usually massive. Brittle. Cleavage, one distinct. Luster vitreous to greasy. Color grayish red to smoky gray. Streak pale gray. H. = 5½-6. G. = 4.1.

Fuses to a black mass. Soluble in hydrochloric acid with gelatinization. Gives manganese and usually iron reactions.

San Diego County: **1,** Tephroite has been found with quartz and garnet in a quartzite boulder near the summit of San Onofre Mountain, Woodford (2) p. 194.

Santa Clara County: **1,** Grayish-red tephroite in small residual masses occurred in the manganese boulder found near Alum Rock Park, 5 miles east of San Jose, A. F. Rogers (21) p. 444.

TETRADYMITE

Bismuth telluride, Bi_2Te_2S

Hexagonal-rhombohedral. Commonly in bladed forms foliated to granular massive. Cleavage perfect basal. Metallic luster. Color steel gray. H. = 1½-2. G. = 7.2-7.6.

When fused with the potassium iodide and sulphur flux, it yields a yellow coating on charcoal which is bright red on its outer border. The characteristic reaction for all tellurides is the violet solution obtained by boiling a little of the powdered mineral in a few drops of concentrated sulphuric acid.

Calaveras County: **1**, Tetradymite was found with gold in the Melones and in the Morgan mines on Carson Hill, associated with other tellurides of this famous telluride locality, Hanks (12) p. 388.

Inyo County: **1**, It was found with rutile, chalcopyrite and bismutite in a brecciated quartz vein in the Cerro Gordo district, Webb (2) p. 399.

Nevada County: **1**, It occurred at the old Murchie mine near Nevada City, Hanks (12) p. 388. **2**, As brilliant scales at Grass Valley, W. P. Blake (6) p. 97.

Siskiyou County: **1**, Sylvanite, reported from the Quartz Hill mine (sec. 16, T. 45 N., R. 10 W., M. D.) by Averill (3) p. 49, has been shown by him (p. c., '45) to be tetradymite.

Tuolumne County: **1**, Tetradymite was found with free gold in calcite and dolomite in the Jumper and Golden Rule mines near Jamestown, Sharwood (5) p. 28. **2**, Bismuth telluride is reported from the Soulsby mine, Sharwood (2) p. 118.

TETRAHEDRITE

Copper antimony sulphide, $(Cu,Fe)_{12}Sb_4S_{13}$

Arsenic may replace antimony in all proportions, and when the ratio As:Sb is more than 1:1, the mineral is called *tennantite*.

Isometric; hextetrahedral. Crystals characteristically tetrahedrons. Also massive; granular. Metallic luster. Color dark steel gray. Streak black, sometimes cherry red. H. = 3.4. G. = 4.4-5.1.

Gives a slight white coating on charcoal and a faint odor of sulphur (in the case of tennantite, the garlic odor of arsenic). The roasted mineral gives the blue bead of copper with borax. Soluble in nitric acid with separation of sulphur; antimony precipitates as trioxide. Ammonia added to nitric-acid solution will give the characteristic blue solution of copper, and will precipitate any iron present.

Freibergite (argentian tetrahedrite) is the argentiferous variety and is perhaps the most common form of the mineral in California.

Tetrahedrite is common in many of the gold and copper mines of the state. It is, however, seldom prominent but occurs in small amounts mixed with galena, sphalerite, chalcopyrite, and other common sulphides.

Alpine County: **1**, Considerable tetrahedrite has been found in the Silver Mountain district, Woodhouse (p. c., '45). **2**, It was observed in the Monitor mining district, Eakle (16) p. 13, Gianella (1) p. 342, Partridge (1) p. 264.

Amador County: **1**, It has been found with chalcopyrite and pyrrhotite at the Argonaut mine, Logan (16) p. 67.

Calaveras County: **1**, Small amounts of tetrahedrite were found in the mines on Carson Hill, Hanks (12) p. 388. It was present in the ore at the Jones mine, Carson Creek, Woodhouse (p. c., '45). **2**, Freibergite occurs disseminated in quartz at the Live Oak mine, Hanks (15) p. 138. **3**, It was found with stibnite at the Blue Wing (secs. 5, 6, T. 3 N., R. 14 E., M. D.), Franke and Logan (4) p. 280. **4**, It occurred at the Ilex mine, Turner (3) p. 468.

Del Norte County: **1**, It was found at Crookshine (N. R.). **2**, With native silver and copper at the Occidental mine (T. 18 N., R. 1 W., H.), Crawford (2) p. 58.

Imperial County: **1**, It appeared in the Bluejacket and other mines of the Picacho district (N. R.).

Inyo County: **1**, Tetrahedrite containing a large percentage of silver was an important mineral in the Cerro Gordo district, C. A. Waring and Huguenin (2) p. 108, Tucker and Sampson (25) p. 432. **2**, It also occurred in some of the mines of the White Mountains and the Dutton Range, Hanks (12) p. 388. **3**, It was found in the old San Carlos mine, Goodyear (3) p. 263. **4**, Freibergite is the principal sulphide in the silver ores of the Panamint district, Stetefeldt (1) p. 259, Crawford (1) p. 374, Murphy (2) p. 321. **5**, Tennantite, the arsenic-bearing equivalent of tetrahedrite, has been reported from the Darwin district by Kelley (4) p. 544. References to other occurrences in the county are as follows: Tucker and Sampson (25) pp. 383, 397, 427, 428; A. Knopf (5) pp. 109, 110; Aubury (1) p. 245; Crawford (1) p. 373.

Kern County: **1**, It occurs with ruby silver and argentite at the Amalie mine, Crawford (2) p. 605.

Los Angeles County: **1**, It was found in the Zapata mine in San Gabriel Canyon, W. P. Blake (9) p. 23.

Mariposa County: **1**, Freibergite was found in large masses in white quartz, at the Live Oak mine, near Mariposa, (N. R.). **2**, It also occurred in the Pine Tree mine, Hanks (12) p. 388. **3**, Near Coulterville, ibid. **4**, In the Louisa and Bunker Hill mines (N. R.). **5**, Tetrahedrite occurs at La Victoria mine (sec. 4, T. 4 S., R. 16 E., M. D.), Aubury (1) p. 213. **6**, Tetrahedrite was found with triboluminescent sphalerite at the Fitch mine, (sec. 9, T. 4 S., R. 15 E., M. D.), Laizure (6) p. 143. **7**, Tetrahedrite was reported at Piñon Blanco, Storms (7) p. 92.

Mendocino County: **1**, It was found with chalcopyrite, gold, and silver, in the Redwood Copper Queen mine, Aubury (1) p. 137.

Mono County: **1**, It occurred massive as the principal primary copper mineral, and the source of most of the silver, in the Diana, Comet, Comanche, and other mines of the Blind Spring Hill district, Whiting (1) p. 378. A. L. Ransome (2) p. 189. **2**, It was also found in the Bodie district, Woodhouse (p. c., '45).

Nevada County: **1**, A heavy mass of tetrahedrite associated with sphalerite and chalcopyrite was found in the Osborn Hill vein, Lindgren (12) p. 119. **2**, Tetrahedrite was found in small quantities at the North Banner and at the other mines of the Banner Hill and Willow Valley districts, ibid. **3**, It is present in the ore of the Badger Hill mining district. **4**, Argentiferous tetrahedrite is abundant in the Central mine of the Lava Cap Gold Mining Corporation at Nevada City, W. D. Johnston, Jr. (3) p. 216.

Placer County: **1**, Dark steel-gray tetrahedrite associated with other sulphide minerals and with electrum was common in the Ophir district, having been noticed in the Boulder, Gold Blossom, Pine Tree, and Golden Stag mines, Lindgren (7) p. 273. **2**, It was also observed at Michigan Bluff (N. R.). **3**, It is reported from Whiskey Hill, with native silver, Silliman (7) p. 351 [this occurrence was placed in Tuolumne County in earlier editions of *Minerals of California*].

Plumas County: **1**, It was found at the Irby Holt mine in Indian Valley, Hanks (12) p. 28. **2**, Argentiferous tetrahedrite was found at the Trask and Coffer mine, (sec. 24, T. 27 N., R. 10 E., M. D.), Logan (4) p. 470. **3**, It was observed in small amounts in the ore at Engels, C. A. Anderson (6) p. 321. **4**, It was found 4 miles from Genesee (sec. 11, T. 25 N., R. 11 E., M. D.), Logan (4) p. 463.

Riverside County: **1**, A small amount of tetrahedrite was found with chalcopyrite, pyrite, and galena, at Crestmore, Eakle (15) p. 352.

San Bernardino County: **1**, Tetrahedrite has been found at Calico, with cerargyrite, Weeks (4) p. 534. **2**, It has been found massive in the New York and other mines in the New York Mountains (N. R.). **3**, At Harrison Gulch, Kramm (2) p. 238. **4**, As freibergite, with argentite, at the Big Dike (sec. 17, T. 31 S., R. 6 W., M. D.), Laizure (1) p. 526. **5**, Freibergite, in crystals and in the massive ore, is found in the California Rand mine, Murdoch (p. c., '45). This is the material considered by Hulin (1) p. 98 to be stylotypite.

Shasta County: **1**, Tetrahedrite is common in the copper mines of the county, although it occurs only in small amounts, Tucker (7) p. 315. It has been found in a barite gangue in the Bully Hill mine, Aubury (1) p. 65. **2**, It occurs with pyromorphite and cerussite at the Chicago claim, 3 miles west of Igo, Hanks (14) p. 125.

Sierra County: **1**, Tetrahedrite occurs in tetrahedral crystals with crystallized gold in the 16 to 1 mine at Alleghany, Ferguson (2) p. 166, E. M. Boyle (3) p. 4.

Siskiyou County: **1**, Tetrahedrite occurs at the Isabella mine (sec. 34, T. 41 N., R. 7 W., M. D.), Laizure (1) p. 532.

Tuolumne County: **1**, Massive tetrahedrite was found in the Golden Rule mine, near Jamestown, Hanks (12) p. 388. **2**, Tennantite has been reported from the Rawhide mine (T. 1 N., R. 14 E., M. D.), F. L. Ransome (9) p. 9, Logan (16) p. 171. **3**, Tetrahedrite comes from the Tioga mine, 3 miles northwest of Mount Dana, Turner (12) p. 715. **4**, From the Alameda mine, Storms (7) p. 92.

THAUMASITE

Hydrous calcium silicate, carbonate, and sulphate, $CaSiO_3 \cdot CaCO_3 \cdot CaSO_4 \cdot 15H_2O$

Hexagonal. Masses of interlaced needles. Vitreous luster. Colorless and white. H. = 3½. G. = 1.877.

Infusible, but swells up when heated, coloring the flame red. Easily soluble. Gives water in a closed tube.

Riverside County: **1**, Thaumasite occurred as veinlets and silky coatings in spurrite at Crestmore. It was observed, described, and analyzed by Foshag (2) p. 80.

San Bernardino County: **1**, Thaumasite occurs with deweylite in small veins cutting dolomite in the Dewey mine about 6 miles east of Valley Wells, Schaller (50) p. 816.

THENARDITE

Sodium sulphate, Na_2SO_4

Orthorhombic. Pyramidal, short prismatic or tabular crystals. Basal cleavage. Vitreous. White to brownish. H. = 3. G. = 2.68.

Fuses easily. Soluble in water. Barium chloride precipitates barium sulphate.

Imperial County: **1**, A large deposit of thenardite occurs about 2½ miles northeast of Bertram, (sec. 9, T. 9 S., R. 12 E., S. B.) in the Salton Sink, Tucker (4) p. 271, (8) p. 87.

Inyo County: **1**, White masses of thenardite occur in the Funeral Range and in the dry depressions of Death Valley, G. E. Bailey (2) pp. 45, 46, Bodewig and Rath (3) p. 181. **2**, Large, blue-gray crystals

of thenardite, some twinned, occur at Deep Springs Valley, Hamilton (4) p. 129.

Kern County: **1**, Thenardite collected by D. G. Thompson from near Buckhorn Springs, 6 miles south of Muroc, was analyzed by R. C. Wells (3) p. 19.

San Bernardino County: **1**, Thenardite forms layers several feet thick at Searles Lake, Robottom (1) p. 82, H. S. Gale (13) p. 292, De Groot (3) p. 535. Large crystals of it often occur as cruciform twins. The crystals were described by Ayres (1) p. 235. **2**, Thenardite has been found pure or mixed with halite at Dale Lake, (sec. 26, etc., T. 1 N., R. 12 E., S. B.), Tucker and Sampson (34) p. 541, Wright, L. A. et al. (5) p. 220.

San Luis Obispo County: **1**, Soda Lake on the Carrizo Plain, a depression between the Caliente and Temblor Ranges, is a dry lake with crusts of thenardite, Arnold and Johnson (7) p. 370, Tucker (4) p. 386.

THERMONATRITE

Hydrous sodium carbonate, $Na_2CO_3 \cdot H_2O$

Orthorhombic. Vitreous. White, grayish yellow. H. = 1-1½. G. = 2.25. Gives strong yellow flame of sodium and an alkaline reaction on heating. Soluble in water and has an alkaline taste.

Thermonatrite occurs as an efflorescence in dry regions.

Inyo County: **1**, Thermonatrite forms white efflorescent coatings in Death Valley, according to G. E. Bailey (2) p. 102.

Lake County: **1**, Clusters of platy needles of thermonatrite occur between halite crystals in specimens from Borax Lake, Murdoch (p. c. '53).

THETIS HAIRSTONE

See quartz

THINOLITE

See calcite

THOMSONITE

Hydrous sodium, calcium, and aluminum silicate, $(Ca,Na)_{12}Al_{10}(Al,Si)_4Si_{20}O_{80} \cdot 24H_2O$

Orthorhombic. Usually radiate fibrous in spherical forms; also compact. Cleavage perfect basal. Brittle. Vitreous luster. Color snow white to brown. Streak uncolored. H. = 5-5½. G. = 2.3-2.4.

Fuses very easily to a white enamel. Gelatinizes with hydrochloric acid.

Colusa County: **1**, Thomsonite occurs with calcite, pectolite, datolite, prehnite, and hydromagnesite as veins in serpentine in a road quarry, near Wilbur Springs, about 2 miles east of the Lake County line, Pabst (p. c., '44).

Kern County: **1**, Thomsonite occurs in veins of radiating clusters in the lavas of Red Rock Canyon, associated with analcime and natrolite, Murdoch (p.c. '51).

Los Angeles County: **1**, Thomsonite occurs as platy crystals in basalt in the Pacific Electric quarry, Brush Canyon, Neuerberg (p. c., '45).

Plumas County: **1**, Thomsonite has been found at the Engels mine, Graton and McLaughlin (4) p. 18.

THORITE—Uranothorite

Thorium silicate, $ThSiO_4$, usually with H_2O from alteration

Tetragonal, usually in square prisms, crystals resembling zircon. Also massive compact. Distinct prismatic cleavage. Color black, or when altered, orange. Luster vitreous to resinous. H. = 4.5-5. G. = 4.4-5.4. Transparent to nearly opaque. Orangeite is altered thorite. Characteristic of pegmatite dikes.

Thorite has been reported as a minor constituent of placer sands along the Feather, Yuba, American, Mokelumne, Tuolumne, and Merced Rivers, from Oroville in Butte County to Snelling in Merced County. It has also been observed in placer sands on Scott River near Callahan in Siskiyou County and at Atolia in San Bernardino County, George (1) pp. 129-132.

Los Angeles County: **1**, Uranothorite is found in small amount in one part of the zircon-allanite pegmatite in Pacoima Canyon, (sec. 17, T. 3 N., R. 13 W., S. B.), Neuerburg (2) p. 834.

Riverside County: **1**, Thorite, variety "orangeite," has been found in small irregular patches in the contact zone at Crestmore on the 910-foot level, Murdoch (p.c. '51).

THOROGUMMITE

Hydrous thorium silicate, $Th(SiO_4)_{1-x}(OH)_{4x}$

Fine-grained aggregates, as a result of hydration of thorite or other thorium minerals. Isostructural with thorite, with virtually identical unit cell size. The name has priority over *hydrothorite*, *nicolayite*, *maitlandite*, *mackintoshite* or *hyblite*, which are all minor chemical variants of a single phase.

Riverside County: **1**, Small powdery white, square crystals in the Southern Pacific Silica quarry at Nuevo, test for thorium and silica, and give the X-ray powder pattern of thorogummite, Murdoch and Hawley (p.c. '54).

THULITE

See zoisite

TIEMANNITE

Mercuric selenide, HgSe

Isometric; hextetrahedral. Generally massive; compact. Brittle, metallic luster. Color steel gray to dark lead gray. Streak black. H. = 2½. G. = 8.19-8.47.

Gives the peculiar "rotten-radish" odor of selenium when heated on charcoal. Reduces easily to metallic globules of mercury.

Lake County: **1**, According to W. P. Blake (9) p. 21, tiemannite occurred in large masses near Clear Lake. Masses of it occurred in the Abbott mine associated with cinnabar and petroleum, Watts (2) p. 240. **2**, Tiemannite is reported in the ore of the Helen mine (sec. 1, T. 10 N., R. 8 W., M.D.), Yates and Hilpert (4) p. 278, Watts (2) p. 240.

Orange County: **1**, It was doubtfully reported to occur with cinnabar and metacinnabar at the San Joaquin Ranch mine, S. M. B. (12220).

Santa Clara County: **1**, It was found with cinnabar at the old Guadalupe mine near New Almaden (N. R.).

Sonoma County: **1**, It occurred with native mercury at the Socrates mine (sec. 32, T. 11 N., R. 8 W., M. D.), W. W. Bradley (5) p. 195.

* TILLEYITE, 1933

Calcium carbonate and silicate, $2CaCO_3 \cdot Ca_3Si_2O_7$

Monoclinic. Color white. One perfect cleavage. G. = 2.838. Effervesces and gelatinizes with acid.

Riverside County: **1**, Tilleyite was discovered in the contact zone at Crestmore, and named by Larsen and Dunham (15) pp. 469-473. Analysis by Gonyer:

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	H_2O	CO_2
24.09	0.61	0.12	0.43	57.75	1.09	15.82 = 99.91%

Analysis of excellent material from Ireland, Nockolds (1) p. 151, indicates that the formula should be $2CaCO_3 \cdot Ca_3Si_2O_7$, instead of $CaCO_3 \cdot Ca_2SiO_4$.

TIN

Sn

Tetragonal. Fracture hackly. Ductile, malleable. H. = 2. G. = 7.31. Color tin white. Irregular rounded grains.

Metallic tin is a great mineralogic rarity, and its occurrence in California may be considered doubtful.

Humboldt County: **1**, A small round nugget, S. M. B. (15100), from Orleans Bar hydraulic mine, is said to be tin.

Tuolumne County: **1**, Tin is doubtfully reported also from Columbia, S. M. B. (13082).

* TINCALCONITE—Mohavite, 1878

Hydrous sodium borate, $Na_2B_4O_7 \cdot 5H_2O$

Hexagonal-rhombohedral. Fine-grained crystalline powder. Dull white. Soft. G. = 1.88.

The name tincalconite was given by C. U. Shepard (3) p. 144, to a pulverulent and efflorescent sodium borate from California containing 32 percent water. It is rapidly formed wherever borax is exposed to dry air.

Kern County: **1**, Tincalconite occurs as a coating on borax and kernite in the Kramer district, Vonsen (1) p. 76, Schaller (45) p. 163.

San Bernardino County: **1**, Well formed crystals of tincalconite up to 4 mm. across have been found in drill cores at Searles Lake, associated with trona and borax, Pabst and Sawyer (10) p. 472.

TINSTONE

See cassiterite

TITANITE

See sphene

TOBERMORITE

Hydrous calcium silicate, $CaSiO_4 \cdot H_2O$

Orthorhombic. 001 plates, finely fibrous and granular. Cleavage, two perfect. Silky luster. White. H. = 2.5. G. = 2.44. Dissolves in HCl leaving gelatinous silica.

Named for locality, Tobermory, Island of Mull, by Heddle, 1880 (Dana System 6th ed.), but discredited later when it was thought to be same as gyrolite. Reinstated recently by X-ray diffraction analysis, it has by the same method been found identical with crestmoreite, and

with the material in old specimens labeled riversideite, now hydrated by air moisture to crestmoreite. Taylor (1).

Optical and chemical properties of riversideite reported by Eakle (15) are like those of a substance of a lowered hydration produced in tobermorite by heating, McConnell (1).

Riverside County: **1,** Crestmoreite and riversideite were described from Crestmore by Eakle (15), crestmoreite as soft, white grains, crystals and masses, pseudomorphic after wilkeite. It occurs in blue calcite, monticellite and vesuvianite. Riversideite as described in white fibrous veinlets in vesuvianite has not been re-identified.

TOPAZ

Aluminum fluo-silicate, $Al_2(F,OH)_2SiO_4$

Orthorhombic. Prismatic crystals. Also granular, coarse or fine. Cleavage perfect basal. Brittle. Vitreous luster. Color straw yellow, wine yellow, white, bluish, greenish. Streak uncolored. H. = 8. G. = 3.4-3.6.

Infusible. Ground with a few beads of phosphorous salt and heated in a bulb tube will yield hydrofluoric acid which etches the glass and forms a white ring or coating of silicon fluoride. Moistened with cobalt nitrate and intensely heated, becomes sky blue. Partially attacked by sulphuric acid.

Butte County: **1,** Topaz was mentioned by Silliman (13) p. 385 as minute crystals in the sands at Cherokee, noted also in Silliman (12) p. 133, and Hanks (12) p. 42.

El Dorado County: **1,** Topaz is reported from this county, location not given, Ball (4) p. 1387.

Fresno County: **1,** Topaz is said to occur with beryl at the feldspar deposit, 5 miles northeast of Trimmer, Tucker (1) p. 43. The location for this mineral in Fresno County probably is not authentic, Noren (p.e. '54).

Mono County: **1,** A small amount of granular topaz occurs in andalusite at the mine of Champion Sillimanite, Incorporated, on the western slope of the White Mountains, 7 miles east of Mocalno, Jeffery and Woodhouse (3) p. 461, Kerr (3) p. 620.

San Diego County: **1,** Fine large crystals of colorless and aquamarine topaz occurred at the Little Three and Surprise mines, near Ramona, Hanks (12) p. 46. Some of them resemble topaz from the Urals. **2,** Fine crystals of topaz, light green in color, occur in the Aguanga Mountains, Sterrett (10) p. 327. **3,** Good bluish topaz resembling Ural topaz has been found at the Mountain Lily mine, near Oak Grove S. M. B. (18621).

TOPAZOLITE

See garnet

TORBERNITE

A hydrous phosphate of uranium and copper, $Cu(UO_2)_2P_2O_8 \cdot 12H_2O$

Orthorhombic. Crystals usually square tables. Also foliated, micaceous. Cleavage, perfect micaceous. H. = 2-2.5. G. = 3.2. Luster pearly, subadamantine. Color, emerald and grass green. Streak paler. Yields water in the closed tube.

Fuses easily. With salt of phosphorous gives a green bead, which with tin on charcoal becomes opaque red on cooling. Soluble in nitric acid.

Inyo County: **1,** Gianella (p. e., '37) has identified thin green tetragonal scales from near Oasis, as torbernite.

Kern County: **1**, Scales of torbernite have been reported with autunite 8 miles north northeast of Randsburg on the Searles Lake road, Woodhouse (p. c., '45). **2**, Torbernite occurs with autunite on the property of the Miracle Mining Company, near Miracle Hot Springs, in Kern Canyon, Min. Inf. Service (9) p. 18.

TOURMALINE

Aluminum borosilicate with various bases

Hexagonal-rhombohedral; ditrigonal—pyramidal. In long prismatic crystals; divergent radiating groups. Brittle. Vitreous to resinous luster. Color black, brown, blue, green, rose red, violet, colorless. Streak uncolored. H. = 7-7½. G. = 2.98-3.2.

Generally fusible to a blebby mass. Fused on platinum wire with a mixture of potassium bisulphate and fluorite, will give a momentary green flame. Insoluble in acids.

Pink or red tourmaline is often called *rubellite*.

Black tourmaline is a very common mineral, and large areas of tourmaline granites exist in the Sierra Nevada. The richly colored red and green tourmalines of San Diego County are the finest in the world, and have become widely known and used as gems. Tourmaline always occurs in prismatic crystals, often bunched into radiating groups and usually much fractured. The common black tourmaline is characteristic of granites and quartz veins in granites. Brown tourmaline is found in crystalline limestone near contacts with intrusive igneous rock. Translucent pink or green tourmaline contains lithium and is found only in pegmatites.

The best description of the discovery and occurrence of lithia tourmalines in California, is to be found in Bulletin 37 of the State Mining Bureau, by George F. Kunz (24). An early note on rubellite in the state reports it in 1881 as needles in white lepidolite, but gives no locality beyond the "Bernardino Range in Southern California," W. P. Blake (23) p. 376, (24) p. 207.

Alpine County: **1**, Black tourmaline is common in Hope Valley in pegmatite dikelets of the area, Woodhouse (p. c., '45).

Calaveras County: **1**, Black tourmaline occurs in quartz in Sheepranch, Hanks (12) p. 390.

El Dorado County: **1**, Black tourmaline occurs with orthoclase at Bucks Bar (N. R.). **2**, Black tourmaline occurs at Emerald Bay, Lake Tahoe (N. R.).

Fresno County: **1**, Black crystals of tourmaline with hornblende and quartz occur in Watts Valley (N. R.). **2**, Black tourmaline occurs in the Sycamore district (N. R.). **3**, Red and green tourmaline occur in quartz on the White Divide, south of Mount Goddard, W. W. Bradley (2) p. 439. **4**, Green tourmaline with brown garnet occurs on Spanish Peak, ibid. **5**, Green radiating clusters of tourmaline came from a road cut east of Trimmer, on the north side of Kings River, Noren (p. c., '45). **6**, Black crystals up to 6 inches in size were found in feldspar on a hill in the southwest corner of Clarks Valley, Noren (p. c., '35).

Imperial County: **1**, Fine grained black tourmaline is found in veinlets 6 miles north of 4S Ranch, 1½ miles west of the Colorado River, Kelley (1) p. 137.

Inyo County: **1**, Black tourmaline occurs in the Lee district (S. M. B. 7878). **2**, Black crystals of tourmaline occur in a metamorphosed sand-

stone at Deep Canyon, west of Bishop, A. Knopf (6) p. 233. **3**, It is found as needles and reticulated masses of black, slender prisms in the Slate Range (N. R.). **4**, Small crystals of tourmaline occur in contact rock at Darwin, Kelley (4) p. 540.

Kern County: **1**, Black tourmaline is found in the rocks of the Tehachapi Mountains, (N. R.). **2**, Black tourmaline occurs in a schist 2 miles south of Randsburg, Murdoch (p. c., '45). **3**, A large vein of quartz and feldspar containing black tourmaline occurs near Woody (N. R.).

Los Angeles County: **1**, Numerous small occurrences of tourmaline in slender black crystals, are recorded at localities 21, 22, 23, 24, 25, in the Santa Monica Mountains, Neuerburg (1) p. 160.

Madera County: **1**, Black tourmaline occurs in pegmatites on Iron Mountain near Raymond, Goudey (1) p. 27. **2**, In Fine Gold Gulch, Hanks (15) p. 138.

Modoc County: **1**, Black tourmaline crystals occur in quartz near Cedarville, (N. R.).

Mono County: **1**, Radiating masses of black tourmaline occur near a contact mass of magnetite, which carries greenockite, near Topaz, (N. R.). **2**, A small amount of black tourmaline is found in the andalusite mine in the White Mountains, Woodhouse (4) p. 38.

Nevada County: **1**, Dark-brown tourmaline was found 2 miles northwest of Colfax, Lukesh and Buerger (1) p. 143, and analyzed by Melville (5) p. 39. **2**, Tourmaline is reported from Meadow Lake, Lindgren (18) p. 258.

Orange County: **1**, Black tourmaline is found at the Santa Ana tin mine, Santa Ana Mountains (N. R.).

Placer County: **1**, Black tourmaline occurs at Soda Springs. **2**, With quartz near Blue Canyon and at the Excelsior mine, near Cisco (N. R.). **3**, Black tourmaline with white feldspar and glassy quartz occurs in granitic rock near Rocklin (N. R.).

Plumas County: **1**, Black tourmaline occurs at Red Clover Creek (N. R.). **2**, Black tourmaline in quartz occurs on Grizzly Range, and near Taylorsville (N. R.). **3**, Small crystals occur in the Diadem lode south of Meadow Valley, Turner (17) p. 6. **4**, Doubly terminated black tourmaline crystals as much as 3″ in size have been found in chlorite schists between Oroville and Quincy, near Feather River, Williams (p.c. '49).

Riverside County: **1**, Fine gem tourmaline occurs near Coahuila and in the San Jacinto Mountains. The first discovery of gem tourmalines in California was made in 1872, on the south slope of Thomas Mountain (sec. 28, T. 6 S., R. 3 E., S. B.), by Henry Hamilton, Hanks (12) p. 21, F. J. H. Merrill (2) p. 577. **2**, The San Jacinto gem mine (sec. 1, T. 7 S., R. 3 E., S. B.) was discovered in 1893—from "float" crystals of colored tourmaline, some as large as 9 inches long, ibid., Kunz (9) p. 765. **3**, The Columbia mine (SW$\frac{1}{4}$ sec. 1, T. 7 S., R. 3 E., S. B.) on Coahuila Mountain is one of the oldest gem mines in the state, Kunz (23) p. 968. **4**, Black tourmaline occurs in the pegmatite veins at Crestmore, Eakle (15) p. 350. **5**, Black radiating prisms of tourmaline occur with axinite on Box Spring Mountain (N. R.). **6**, Black tourmaline occurs with cassiterite in the Cajalco tin mine about 11 miles southwest of Riverside, Fairbanks (4) p. 111, West (3) p. 131.

San Bernardino County: **1,** Black tourmaline occurs in a schist with clinozoisite in the Sierra Pelona Valley (center sec. 12, T. 5 N., R. 14 W., S. B.), Neuerburg (p. c.. '44). **2,** Well-formed crystals of tourmaline occur abundantly in a muscovite schist near Wrightwood, Schwartz (p. c. '54).

San Diego County: **1,** A series of pegmatite veins consisting mainly of white albite with quartz and lepidolite cut through the diorite hills in the northwestern part of the county from Mesa Grande northward through Pala. These veins have been prolific in their yield of beautiful transparent tourmalines in many shades of rose red and green. The first material obtained was the lavender and lilac lepidolite containing radiating clusters of bright-red rubellite prisms, which form beautiful museum specimens and can be seen in most mineral collections. The gem varieties were found later, Fairbanks, (5) p. 35, and since 1893 a number of mines have been located and many beautiful large crystals obtained. At present the best tourmalines come from Mesa Grande. Sterrett (1) p. 459, measured and described a number of interesting crystals of tourmaline from Damarons Ranch, 4 miles northwest of Mesa Grande.

2, Black, pink, blue, violet, green, and colorless tourmaline occurs at Rincon in the Victor and other claims, A. F. Rogers (4) p. 213.

Analyses of the tourmaline of the county have been made by Schaller, Clarke (9) p. 278.

3, Bluish-green tourmaline is found in the Mountain Lily mine near Oak Grove, Hanks (12) p. 124, Sterrett (9) p. 688. **4,** Fine blue and pink tourmaline occurs at the Peter Cabat mine, about 6 miles north of Warners Hot Springs, Schaller (37) p. 856. **5,** A deposit of green tourmaline occurs south of Banner (sec. 12, T. 9 S., R. 3 E., S. B.), Sterrett (2) p. 1240, Schaller (37) p. 856. **6,** Good blue and green tourmaline occurs on the east side of Chihuahua Valley, Schaller (36) p. 353. The occurrences, **7,** at Mesa Grande are described by Kunz (24) p. 59, Fairbanks (5) p. 36; and **8,** at Pala, by Kunz (18) p. 264, (24) p. 60, Fairbanks (5) p. 36. Tourmaline from Pala shows spectroscopic traces of germanium, Papish (2) p. 475. **9,** Tourmaline is found with axinite and smoky quartz in Moosa Canyon (E½ sec. 27, T. 10 S., R. 3 E., S. B.), Hanks (12) p. 62. **10,** Slender dark prisms of tourmaline occur with quartz on Elder Creek (sec. 27, T. 9 S., R. 4 E., S. B.), Durrell (p. c., '44). **11,** Antisell (1) p. 119 reported "schorl" between Warners Ranch and San Felipe. **12,** Martinez (1) p. 39 mentioned "schorl" near San Diego as early as 1792.

Shasta County: **1,** Small rosettes of black tourmaline occur at the Mountain Monarch prospect, Weaverville quadrangle, Ferguson (1) p. 43.

Tulare County: **1,** Black tourmaline occurs in Frazier Valley S. M. B. (10320), **2,** Drum Valley, Angel (2) p. 732, and **3,** at Mineral King with pyromorphite, Goodyear (3) p. 646. **4,** Large crystals are found in Griffiths Canyon (sec. 9, T. 17 S., R. 28 E., M. D.), Goodyear (3) p. 644. **5,** Large crystals, up to 2 feet long, occur with rose quartz in pegmatite in W½ sec. 15, T. 17 S., R. 27 E., M. D., Durrell (p. c., '35).

Tuolumne County: **1,** It occurs as black prisms with quartz about 8 miles south of Sonora (N. R.).

† TRAUTWINITE, 1873

See chromite

TREANORITE

See allanite

TREMOLITE

See amphibole

TRIDYMITE

Silicon dioxide, SiO_2

Orthorhombic. Thin pseudo-hexagonal plates, often overlapping. Brittle. Vitreous luster. Colorless to white. H. = 7. G. = 2.28-2.33.

Reactions the same as for quartz.

Tridymite is a form of silica which is found in recent volcanic rocks. It is generally in crystals of microscopic size and therefore is rarely seen, except in thin sections of rocks. As a rock mineral it may occur in any of the recent volcanics.

Imperial County: **1,** Tridymite with cristobalite and feldspar is a principal constituent of an altered rhyolite obsidian which makes up Cormorant Island in the Salton Sea, A. F. Rogers, (29) p. 219, (42) p. 328.

Inyo County: **1,** Tridymite occurs in lithophysae in obsidian at Little Lake, 40 miles south of Owens Lake, F. E. Wright (2) p. 368, A. F. Rogers (23) p. 215.

Lake County: **1,** Druses and groups of sharp tridymite crystals occur in vugs and seams in andesite in Seigler Canyon, near Lower Lake, Wilke (p. c., '36), and as coronas about quartz inclusions in the basalts of the area, C. A. Anderson (9) p. 637.

Los Angeles County: **1,** Tridymite has been identified in the volcanics of Santa Catalina Island, A. F. Rogers (30) p. 80. **2,** It occurs as white hexagonal plates in an old lava between Pomona and Spadra at the south foot of the Puente Hills, Foshag (p. c., '46).

Mono County: **1,** Schaller (8) p. 128 has described small plates of tridymite with complex forms, in the cavities of lava 8 miles west of Bridgeport.

Plumas County: **1,** Crystals of tridymite in andesite have been found north of Portola on the Smith Peak road (sec. 4, T. 23 N., R. 13 E., M. D.), Durrell (2) p. 501. **2,** In cavities of pyroxene andesite with anauxite at Drakesbad (T. 30 N., R. 5 E., M. D.), A. F. Rogers (38) p. 160.

San Diego County: **1,** Tridymite constitutes up to 25 percent of a dacite volcanic neck at Morro Hill, 6 miles south of Fallbrook (sec. 23, T. 10 S., R. 4 W., S.B.), Larsen (17) p. 111.

San Luis Obispo County: **1,** Tridymite is found in lithophysae in rhyolite on Black Mountain in the southern Santa Lucia Range, Taliaferro and Turner (2) p. 237.

Shasta County: **1,** Tridymite has been described by C. A. Anderson (8) p. 242 as a secondary mineral at Bumpass Hell and other hot springs in Lassen Volcanic National Park. **2,** It occurs abundantly in vesicular basalts on the road to Terrys Mill, east of Round Mountain, Melhase (3) No. 6, p. 1.

Sonoma County: **1**, Tridymite occurs in cavities of andesite, coated by hisingerite, sec. 10, T. 7 N., R. 7 W., M.D., in Los Alamos Canyon, Rose (p.c. '50).

Tuolumne County: **1**, It occurs as very thin, white plates in cavities of an andesite near Jamestown, A. F. Rogers (7) p. 374, (38) p. 160.

TRIPHANE

See spodumene

TRIPHYLITE

Lithium and iron phosphate, $LiFePO_4$

Orthorhombic. Commonly massive. Cleavage perfect basal. Vitreous luster. Color greenish gray to bluish. Streak uncolored to grayish white. H. = 4½-5. G. = 3.42-3.56.

Easily fusible and soluble. Ammonium molybdate added to a nitric acid solution precipitates yellow ammonium phosphomolybdate. Yields a red lithium flame when fused.

This rare phosphate usually contains manganese and grades into lithiophilite.

San Diego County: **1**, Triphylite was found with lithiophilite and purpurite in the lithia mines at Pala, Hanks (12) p. 125, Graton and Schaller (1) p. 146.

TRIPLITE

Fluo-phosphate of iron and manganese, $3(Mn,Fe)O \cdot P_2O_5 \cdot MnF_2$

Monoclinic. Massive. Cleavage, one distinct. Luster resinous inclining to adamantine. Color pink, brown to black. Streak yellowish gray or brown. H. = 4-5½. G. = 3.44-3.8.

Fuses easily to a black magnetic globule. With borax it gives an amethystine bead and with sodium carbonate a green bead. Soluble in hydrochloric acid. Usually gives a fluorine test when dissolved with sulphuric acid.

Triplite is a rare mineral usually found with tungsten minerals in pegmatite veins.

San Bernardino County: **1**, Triplite was found with hübnerite on specimens from a deposit at Camp Signal, about 9 miles north of Goffs, Hess (14) p. 57.

San Diego County: **1**, Triplite derived from lithiophilite was found at Pala, Hanks (12) p. 125, G. A. Waring (2) p. 363, Schaller (29) p. 145.

TROILITE

Ferrous sulphide, FeS

Hexagonal. Massive. Compact granular. Metallic luster. Color light grayish brown. Speedily tarnishes to bronze brown. Streak black. H. = 3½-4½. G. = 4.67-4.82.

Fuses to a black magnetic mass. Easily soluble in dilute sulphuric acid and generates strong hydrogen sulphide fumes and odor.

Del Norte County: **1**, Troilite was found massive in a sheared zone of serpentine, in a copper claim northeast of Crescent City. It was analyzed and described by Eakle (9) p. 77. Analysis of the soluble portion gave:

	Fe	S
1.	58.78	33.62
2.	62.70	35.40

It contains inclusions of magnetite from which it has probably been derived. This is the only known terrestrial occurrence of troilite. It had been observed previously in meteorites.

TRONA—Urao

Hydrous carbonate and bicarbonate of sodium, $Na_2CO_3 \cdot HNaCO_3 \cdot 2H_2O$

Monoclinic. In plates or slender crystals; often fibrous or columnar massive. One perfect cleavage. Vitreous, glistening. Gray or yellowish white. H. = 2½-3. G. = 2.11-2.14.

Like natron in reactions. Yields much water in a closed tube.

Trona is found in the deposits of saline lakes or is produced by the evaporation of their waters. Common in playa lakes in Kern, Inyo, San Bernardino, and Riverside Counties, G. E. Bailey (2) p. 102.

Inyo County: **1**, Trona was reported from the borax deposits of Death Valley by Bodewig and Rath (3) p. 181, G. E. Bailey (2) pp. 45, 46. **2**, White layers of trona occur along the shores of Owens Lake, Chatard (3) p. 59, (4) p. 75. Analysis of material formed by evaporation at the edge of the lake shows it to be nearly pure trona, Clarke (9) p. 256.

Lake County: **1**, It occurs at Borax Lake with gay-lussite, pirssonite, and northupite, Vonsen and Hanna (4) p. 103.

Mono County: **1**, Trona in layers of well-formed crystals, occurs with hanksite, in evaporation crusts of halite on the east edge of Mono Lake, Murdoch (25) p. 358.

San Bernardino County: **1**, Thick layers of solid trona occur with borax, hanksite, thenardite, glauberite, and other salts at Searles Lake, Ayres (2) p. 65, G. E. Bailey (2) p. 102, H. S. Gale (13) p. 294. Lathlike crystals are very common, Foshag (21) p. 51.

TSCHERMIGITE—Ammonia Alum

Hydrous aluminum and ammonium sulphate, $(NH_4)_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$

Isometric. Octahedral crystals, fibrous, crusts. Vitreous luster. Colorless or white. H. = 2. G. = 1.64.

Easily fusible. Heated in a closed tube with lime, it gives off odor of ammonia. Gives water in a closed tube. Soluble in water.

Lake County: **1**, Tschermigite was mentioned by Becker (4) p. 389 as an efflorescence at Sulphur Bank.

Sonoma County: **1**, It is found at numerous places in upper Geyser Creek Canyon, The Geysers, A. L. Day and Allen (2) p. 45, as brilliant octahedral crystals, and crusts and crystalline masses. Vonsen (6) p. 289.

TUNGSTITE

Hydrous tungsten oxide, $WO_3 \cdot H_2O$?

Possibly orthorhombic. Microscopic platy crystals, massive, earthy. Color bright yellow, yellowish green. Transparent. One perfect cleavage. H. = 2½. Infusible. Insoluble in acids.

Inyo County: **1**, It has been found on scheelite at the Margarita claim, Sheppard Canyon, W. W. Bradley (32) p. 271, S. M. B. (21114). **2**, It occurs as a coating on stoltzite at the Darwin mine, W. W. Bradley (30) p. 602.

TURGITE

Probably hematite with adsorbed water, and not a definite species

Bright red-brown, with red-brown streak.

Inyo County: **1,** S. M. B. (19597), labelled turgite, is from near Shoshone.

Kern County: **1,** A specimen has come from the Golden Queen mine, near Mojave, J. W. Bradley (p. c., '45).

TURQUOISE

Hydrous aluminum and copper phosphate, $H_5(CuOH)[Al(OH)_2]_6(PO_4)_4$

Triclinic. Massive. In thin seams and incrustations. Waxy luster. Color sky blue, bluish green, apple green. Streak white or greenish. H. = 5-6. G. = 2.6-2.83.

Infusible and becomes brown or black when heated. After fusion with sodium carbonate and dissolving in nitric acid, the phosphate reaction is obtained on addition of ammonium molybdate to solution. Gives water in a closed tube. Soluble in hydrochloric acid.

Imperial County: **1,** Bluish-green turquoise in pockets and nodules, has been found about 2 miles east of Midway Well on the trail to the True Friend and Silver Mom mines, on the east slope of the Chocolate Mountains, Tucker (11) p. 270.

Madera County: **1,** A specimen of turquoise having a hexagonal form, from the Taylor Ranch, was described as a pseudomorph after apatite, J. D. Whitney (4) p. 5, G. E. Moore and von Zepharovich (4) p. 240, Kunz (24) p. 107.

San Benito County: **1,** Narrow veins of turquoise appear cutting glaucophane schist about 4½ miles north of Llanada, sec. 33, T. 14 S., R. 10 E., M.D., Chesterman (p.c. '51).

San Bernardino County: **1,** Turquoise mines, worked by the prehistoric Indians, whose stone hammers and inscriptions still remained, were rediscovered in 1897, and in 1898 the San Francisco Call sent an expedition under Dr. Gustav Eisen to explore them. A most interesting account of this expedition was published in the Call of March 18, 1898, Eisen (1) p. 2, and has been extensively quoted by Kunz (24) p. 107. This area is in the Turquoise Mountains (T. 16 N., R. 10, 11 E., S. B.), along the southern edge of the township. A map of this area giving the localities was printed by M. J. Rogers (1). Two groups of claims, the Toltec and Himalaya, have been worked, with considerable production of light-green gem material, Kunz (24) p. 107. **2,** Turquoise has been mined in the Solo mining district (T. 16 N., R. 8 E., S. B., approx.), Tucker and Sampson (16) p. 307. **3,** Turquoise in black matrix has come from Goldstone Camp, 30 miles north of Barstow. An occurrence described as near Granite Wells, 22 miles east of Johannesburg, M. J. Rogers (1), may be the same. **4,** The Gove turquoise mine, 2 miles east of Cottonwood siding on the Santa Fe Railroad, has been fully described by Sterrett (5) p. 780, Pogue (1) p. 47. **5,** Specimens have come from near Goffs mining district, Kunz (24) p. 107. **6,** Martin (2) p. 317 reports turquoise near Barnwell in the New York Mountains. **7,** Apple-green turquoise has been reported near Victor (N. R.).

San Luis Obispo County: **1,** Nodular earthy masses of turquoise have been found near Paso Robles, Gregory (p.c. '51).

* TYCHITE, 1905

Carbonate of sodium and magnesium with sodium sulphate, $2MgCO_3 \cdot 2Na_2CO_3 \cdot Na_2SO_4$

Isometric. Small octahedral crystals. Vitreous. White. H. = 3½-4. G. = 2.58.

Similar to northupite in its reactions.

San Bernardino County: **1,** A few small octahedrons of tychite were mixed with the northupite crystals discovered at Searles Lake. They were analyzed and named by Penfield and Jamieson (7) p. 217, H. S. Gale (13) p. 308. Foshag (21) p. 51 found minute, sharp, clear crystals.

SO_3	CO_2	MgO	Na_2O
15.08	33.55	15.83	35.49 = 99.95%
15.06	33.45	15.77	35.65 = 99.93%

ULEXITE

Hydrous sodium and calcium borate, $NaCaB_5O_9 \cdot 8H_2O$

Triclinic. Usually in nodules or compact fibrous masses. Silky luster. Color white. H. = 1. G. = 1.96.

Fuses with strong yellow flame to a clear glass. Turmeric paper immersed in a hydrochloric-acid solution of ulexite becomes red on drying. Calcium can be determined as the oxalate by precipitation from a very weak hydrochloric-acid solution. Gives much water in a closed tube. Soluble in acids; slightly soluble in water.

The white silky balls of ulexite are frequently found at some of the desert depressions, often with borax.

Inyo County: **1,** Surface incrustations of ulexite are found at some of the sinks in Death Valley (Furnace Creek, Bennetts Wells, etc.), Hanks (12) p. 394, Bodewig and Rath (3) p. 181, G. E. Bailey (2) pp. 45, 46. **2,** Ulexite occurs in large compact masses with colemanite at Mount Blanco, Foshag (13) p. 420. **3,** Ulexite occurs in great abundance with colemanite and probertite in the Widow and Biddy McCarthy mines near Ryan, Foshag (18) p. 338. **4,** Ulexite with colemanite has been found near Shoshone, 1 mile west of center T. 22 N., R. 7 E., S. B., Noble (3) p. 72. **5,** Ulexite has been found in Mesquite Valley, S. M. B. (14595).

Kern County: **1,** Ulexite was mentioned from the Cane Spring [Kane (Koehn) Spring, Mesquite Spring, Desert Spring, Desert Well] district (T. 30 S., R. 38 E., M. D.), Silliman (12) p. 130, J. A. Phillips (4) p. 637 [boronatrocalcite], W. P. Blake (23) p. 323, G. E. Bailey (2) p. 50. **2,** It occurs abundantly as compact fibrous veins in clay-shale in the Kramer district, Schaller (4) p. 24, (45) p. 138. Crystals from the Suckow mine have been described by Murdoch (10) p. 754.

Lake County: **1,** Ulexite from Lake Hachinhama was mentioned in Hanks (11) p. 38.

Los Angeles County: **1,** Ulexite is found in compact divergent masses with probertite at Lang, Foshag (1) p. 35, (7) p. 200.

Riverside County: **1,** Ulexite is reported by G. E. Bailey (2) p. 54 from the foothills of the San Bernardino Range, northeast of the Salton Sea.

San Bernardino County: **1,** Small amounts of ulexite occur with colemanite at Borate, near Yermo, Foshag (9) p. 209. **2,** Float ulexite, with colemanite was reported from the Lower Canyon, Amargosa River, G. E. Bailey (2) p. 62, Cloudman et al. (1) p. 855. **3,** It has been re-

ported from the playa at Coyote Holes [Willow Springs Lake], (T. 11 N., R. 2 E., S. B.), Hanks (11) p. 28, G. E. Bailey (2) p. 62, Cloudman et al. (1) p. 855.

Shasta County: **1**, An incrustation at Lick Springs, called "borocalcite of Hayes" by J. B. Trask (7) p. 61, may be either ulexite or bechilite.

URACONITE

Hydrous uranium sulphate, SO_3,UO_3,H_2O

Orthorhombic. Minute laths. Earthy or scaly. Color lemon yellow. Soft.

In addition to the uranium reaction, the mineral will give water in a closed tube. Soluble in acid.

Calaveras County: **1**, Uraconite "yellow uranium ochre" occurs as an alteration product of pitchblende in coatings in contact with gold at the Rathgeb mine, near San Andreas, Rickard (1) p. 329.

URANINITE—Pitchblende

Uranium oxide, UO_2 (usually so oxidized that it is nearer $U_{3-4}O_8$)

Isometric. Crystals rare. Generally massive and botryoidal. Brittle. Submetallic to pitch-like luster. Color and streak grayish, greenish, brownish black. H. = 5-6. G. = 8-10, crystals; massive altered forms from 6.4 upwards.

Before the blowpipe infusible. With borax and salt of phosphorus gives a yellowish-green bead in the oxidizing flame, becoming a fine clear green in the reducing flame. Soluble in nitric and sulphuric acids. Strongly radioactive.

Calaveras County: **1**, Uraninite was found in acicular crystals in a pocket with spongy gold, quartz, and clay at the Rathgeb mine, near San Andreas, Rickard (1) p. 329, (2) p. 215, Logan (16) p. 147.

San Bernardino County: **1**, Pitchblende has been found in the Scotty Wilson mine, VanDusen Canyon, sec. 4, T. 2 N., R. 1 E., S. B. It occurs in a podlike mass of metallic sulphides in limestone, Wright, L. A., et al. (5) p. 112.

URAO

See trona

URANOTHORITE

See thorite

UVAROVITE

See garnet

VALENCIANITE

See feldspar, orthoclase

VALENTINITE

Antimony oxide, Sb_2O_3

Orthorhombic. In prismatic crystals. Generally columnar masses. One cleavage perfect. Adamantine luster. Color snow white to ash gray, lemon yellow. Streak white. H. = 2½. G. = 5.76.

Gives white coating, but no odor on charcoal. Gives no sulphur in closed tube.

Valentinite is an oxidation product of antimony minerals, especially of stibnite, and probably present in most of the antimony mines of the state.

Inyo County: **1**, Valentinite is reported to occur with stibnite and cervantite at the Bishop antimony mine 4½ miles south of Bishop, Woodhouse (p. c., '45). **2**, Valentinite probably occurs in Wildrose Canyon, as a brownish crust on stibnite, D. E. White (1) p. 317.

Kern County: **1**, Valentinite occurs with antimony and stibiconite along Erskine Creek, Behre (1) p. 331. **2**, Tabular crystals, and coatings, have been found in Lone Tree Canyon, Murdoch (13) p. 613.

San Benito County: **1**, Lemon-yellow bladed aggregates of valentinite, probably pseudomorphs after stibnite, with cinnabar, quartz, and chalcedony, occur at the Picahotes (Picachos) mine, A. F. Rogers (7) p. 374.

Santa Clara County: **1**, Goldsmith (3) p. 369 notes small crystals of valentinite with stibioferrite, from this county.

VANADINITE

Lead chloro-vanadate, $(PbCl)Pb_4(VO_4)_3$

Hexagonal. Small prisms. Brittle. Somewhat resinous luster. Color deep ruby red, straw yellow, reddish brown. Streak white or yellowish. H. = 3. G. = 6.66-7.10.

Fused on charcoal with sodium carbonate, the mineral is reduced to metallic lead with a yellow sublimate on the coal. The green bead of vanadium can be obtained with phosphorus salt. Dissolved in nitric acid and a drop of silver nitrate added to the solution, silver chloride will be precipitated. Decomposed by hydrochloric acid.

Kern County: **1**, Vanadinite has been found 2 miles north of Searles Lake (N. R.). **2**, It was found with galena and mimetite near Randsburg (N. R.).

Inyo County: **1**, Occurs as small reddish crystals in crevices from the Emperor mine, Darwin, Woodhouse (p. c., '54).

Mono County: **1**, Vanadinite has been reported near Coleville, W. W. Bradley (29) p. 106.

Riverside County: **1**, Vanadinite has been found at Gold Park, near 29 Palms, in this and San Bernardino Counties, Tucker and Sampson (16) p. 295. **2**, It is reported with galena and carbonate minerals from the Black Eagle mine (sec. 30, T. 3 S., R. 14 E., S. B.), Tucker (8) p. 195, Tucker and Sampson (27) p. 47. **3**, Good crystals have come from the El Dorado mine near Indio, J. S. Brown (1) p. 63. (This occurrence was listed as pyromorphite in Bulletin 113.)

San Bernardino County: **1**, Vanadinite occurs with cerussite and cuprodescloizite in the Vanadium King mine at Camp Signal, near Goffs, Schaller (24) p. 149, Cloudman et al. (1) p. 849. **2**, It was found near Moore Station on the Union Pacific Railroad, S. M. B. (18743).

VANADIUM MICA

See roscoelite

VARISCITE

Hydrous aluminum phosphate, $AlPO_4 \cdot 2H_2O$

Orthorhombic. Octahedral habit. Crystalline aggregates and incrustations. Vitreous luster. Color green. H. = 4. G. = 2.54.

Infusible, but whitens when heated. Moistened with cobalt-nitrate solution and intensely heated, it becomes blue. Gives water in a closed tube. Phosphate can be precipitated by ammonium molybdate from a nitric-acid solution after fusion of the powder with sodium carbonate.

El Dorado County: **1**, Variscite was dubiously reported to have been found in Pleasant Valley. (Specimen in collection of University of California at Berkeley.)

VAUQUELINITE

A phospho-chromate of lead, perhaps $2(Pb,Cu)CrO_4 \cdot (Pb,Cu)_3P_2O_8$

Monoclinic. Crystals; mamillary or reniform. H. = 2½-3. G. = 6. Color green to brown.

San Bernardino County: **1**, Fine crystals, doubtfully identified as vauquelinite, were reported as associated with chromic iron ore from this county, J. R. Browne (4) p. 225.

* VEATCHITE, 1938

Hydrous strontium borate, $Sr_3B_{16}O_{27} \cdot 5H_2O$(?), with some Ca

Monoclinic. Fibrous veins. One perfect cleavage. Pearly luster. Colorless. H. = 2. G. = 2.69.

Fuses easily with intumescence. Yields water in closed tube.

Los Angeles County: **1**, Veatchite occurs in small amount with howlite and colemanite at the old colemanite mine at Lang. It was named and described, with analysis by F. A. Gonyer, by Switzer (2) p. 409. Crystals were described by Murdoch (7) p. 130. A new find in the same locality shows a platy instead of fibrous habit. Switzer and Brannock (6), pp. 90-92.

SrO	B_2O_3	H_2O
32.45	58.16	9.39

VELARDEÑITE

See gehlenite

VERMICULITE

The name vermiculite is applied to a group of micaceous minerals, all hydrated silicates, in part closely related to the chlorites, but varying somewhat widely in composition. Some of the names applied to these are: *Jefferisite, vermiculite, culsageeite.* They do not in general merit species rank.

Fresno County: **1**, Vermiculite is reported in nodules with talc near Humphreys (sec. 22, T. 11 S., R. 23 E., M. D.), Pabst (8) p. 577.

Riverside County: **1**, Brown to black plates up to 15 millimeters in diameter have been found in pegmatite at Crestmore, Woodford et al. (10) p. 374.

San Diego County: Vermiculite has been observed as an alteration of mica, **1**, at Pala, and **2**, at Rincon, G. A. Waring (4) p. 363, 368.

VESUVIANITE—Idocrase

Calcium and aluminum silicate, $Ca_{10}Al_4(Mg,Fe)_2Si_9O_{34}(OH)_4$

Tetragonal. Square prisms. Granular massive. Brittle. Vitreous luster. Color green to brown, purple, colorless. Streak white. H. = 6-6½. G. = 3.35-3.45.

Fuses with intumescence to a greenish or brownish glass. Insoluble, but the fused beads are soluble with gelatinization when powdered.

Vesuvianite is characteristically formed in limestone near a contact with igneous rocks, and often is associated with grossularite garnet.

The variety californite is a compact, massive vesuvianite, sometimes called "California jade," occurring as streaks or nodules in serpentine.

It was named and described from Happy Camp in Siskiyou County, by Kunz (19) p. 397.

Butte County: **1**, Californite is found near Pulga (southwestern part of T. 25 N., R. 8 E., M. D.), Sterrett (6) p. 858. **2**, Californite occurs near Oroville, near the mouth of Feather River as waterworn pebbles, A. F. Rogers (7) p. 377.

Calaveras County: **1**, Vesuvianite occurs with garnet and epidote in Garnet Hill, at the junction of Moore Creek and Mokelumne River, Melhase (6) p. 7.

El Dorado County: **1**, Brown crystals were found in the Siegel lode near Georgetown, W. P. Blake (15) p. 16. **2**, Veins of vesuvianite have been found on Traverse Creek, 2½ miles southeast of Georgetown (T. 12 N., R. 10 E., M. D.), L. L. Root (4) p. 409. Rather complex crystals of varied color have been described from this occurrence by Pabst (2) p. 1.

Fresno County: **1**, Californite has been produced from the south side of Watts Valley (sec. 5, T. 12 S., R. 24 E., M. D.), Kunz (24) p. 94, W. W. Bradley (2) p. 439. **2**, Californite occurs with white garnet near Selma, Kunz (24) p. 94, Clarke and Steiger (8) p. 72. **3**, Well-formed greenish-brown crystals up to half an inch in diameter are widespread in a contact metamorphic limestone in the Twin Lakes region, Chesterman (1) p. 275.

Inyo County: **1**, Brownish-green vesuvianite intimately intergrown with garnet and white datolite, was found at San Carlos, about 12 miles south of Fish Springs, on the west slope of the Inyo Range, John L. Smith (1) p. 435. **2**, It occurs with garnet in metamorphic rock in Round Valley, west of Bishop, A. Knopf (6) p. 244, Chapman (1) p. 866. **3**, With diopside and epidote about 5 miles east of Ballarat, Murphy (4) p. 349. **4**, With blue calcite, half a mile north of Crystal Dome mine, North Fork Sheppard Canyon (T. 22 S., R. 42 E., M. D.), W. W. Bradley (26) p. 195. **5**, Vesuvianite occurs with scapolite and diopside in the contact zone at the Pine Creek tungsten mine, Hess and Larsen (1) p. 276. **6**, Vesuvianite is not uncommon in the contact zone at Darwin, as dense green masses and crystals in calcite or wollastonite, Kelley (4) p. 539.

Kern County: **1**, Vesuvianite occurs in a contact zone with garnet and wollastonite, as green and brown radial groups up to 6 inches across, 3 miles south of Havilah, D. O'Guinn (p.c., '35). **2**, Small yellow crystals occur in limestone in Jawbone Canyon (N. R.).

Mono County: **1**, Vesuvianite has been found in a contact zone with boulangerite and wollastonite, on the north side of Leevining Canyon (sec. 13, T. 1 N., R. 25 E., M. D.), Murdoch (p. c. '45).

Placer County: **1**, Small crystals occur in metamorphic rock on the old highway about half a mile east of Cisco (T. 17 N., R. 13 E., M. D.), S. G. Clark (p. c. '36). **2**, Vesuvianite has been found in this county, disseminated in massive garnet, A. F. Rogers (51) p. 1222.

Plumas County: **1**, Brownish-green crystals have been found 5 miles from Portola, W. W. Bradley (28) p. 206.

Riverside County: **1**, Flat pyramidal crystals of vesuvianite up to 6 inches across, together with abundant smaller crystals and rounded grains, occur in the contact zone in the Crestmore limestone quarries,

Eakle (15) p. 338, Kelley (2) p. 141. **2**, It is found in the new city quarry, 2 miles south of Riverside, Richmond (1) p. 725.

San Bernardino County: **1**, Vesuvianite, massive and in crystals is associated with greenish garnet, green diopside and uvarovite on the east side of hill which is west of limestone quarry, 11 miles east of Victorville. Bowen (1), p. 32.

San Diego County: **1**, Crystals of gem quality have been found near Jacumba and San Vicente, Kunz (24) p. 95.

Siskiyou County: **1**, The original discovery of californite was made 12 miles from Happy Camp (sec. 7, T. 17 N., R. 7 E., H) Kunz (17) p. 747, (19) p. 397, Averill (5) p. 291. White californite, which is almost indistinguishable from white garnet, has been described from this locality, Sterrett (6) p. 857.

Tulare County: **1**, Red porphyroblasts of vesuvianite have been found with wollastonite and diopside in Kaweah quarries (secs. 35, 36, T. 17 S., R. 27 E., M. D.) 2 miles northeast of Lemon Cove, Durrell (p. c. '35). **2**, Vesuvianite also occurs in sec. 25, T. 17 S., R. 28 E., M. D.) with wollastonite, ibid.

VIOLAN

See pyroxene, diopside

VIOLARITE

A sulphide of nickel and iron, $(Ni,Fe)_3S_4$

Isometric. Crystals and massive. Perfect cubic cleavage. Metallic luster. Color steel gray. H. = 4½. G. = 4.5-5.

Becomes magnetic on heating and gives off sulphur odor. Soluble in nitric acid, giving green solution, which turns blue on the addition of ammonia.

San Diego County: **1**, Violarite occurs with pyrrhotite and chalcopyrite in the nickel ores of the Friday mine at Julian, M. N. Short and Shannon (1) p. 8, Donnelly (1) p. 370. This was earlier considered to be polydymite, Hess (15) p. 747, Donnelly (1) p. 370, Creasey (1) p. 27.

VIOLITE

See quartz, chalcedony

VIVIANITE

Hydrous ferrous phosphate, $Fe_3P_2O_8 \cdot 8H_2O$

Monoclinic. Long prismatic crystals, earthy, incrustations. One perfect cleavage. Sectile. Pearly to dull luster. Color generally sky blue or green, rarely colorless. Streak colorless to bluish white. H. = 1½-2. G. = 2.58-2.68.

Easily fusible to a black magnetic mass. A nitric-acid solution added to ammonium molybdate gives the yellow phosphate reaction. Yields water in a closed tube. Soluble in hydrochloric acid.

Vivianite is frequently formed in sedimentary rocks, from phosphatic matter such as bones, in the presence of iron.

Alameda County: **1**, Small pieces of earthy blue vivianite were found in the hills back of Berkeley, S. M. B. (12983).

Butte County: **1**, Vivianite was doubtfully identified near Oroville, Hanks (12) p. 395.

Calaveras County: **1**, It has been found at Copperopolis (N. R.).

Humboldt County: **1**, Vivianite occurs at Yager, Lowell (1) p. 408. **2**, It is reported to have been found on Maple Creek, ibid.

Inyo County: **1**, Vivianite in crystals on quartz is reported from the Darwin mines, C. D. Woodhouse (p.c. '47).

Los Angeles County: **1**, Vivianite was early observed as earthy blue masses in the asphalt bed of the Rancho la Brea, where it formed by the decomposition of the bones of extinct animals. It was mentioned by W. P. Blake in Hanks (7) p. 265, Hanks (12) p. 395, Turner (22) p. 344.

Madera County: **1**, Dark-blue earthy masses of vivianite have been found near Raymond, S. M. B. (16493).

San Benito County: **1**, Vivianite was identified from the Sulphur Spring ore body of the New Idria mine, W. W. Bradley (p. c., '44), S. M. B. (21197).

San Mateo County: **1**, Chalky blue nodules of vivianite in siliceous rock have been found 1 mile north of Point Año Nuevo, Chesterman (p.c. '51).

Santa Barbara County **1**, Vivianite was found at Concepcion, S. M. B. (18114).

Shasta County: **1**, Vivianite concretions were found near Burney, in diatomite of a Tertiary lake bed, W. W. Bradley (29) p. 107.

Yuba County: **1**, Good crystals of vivianite occurred near Camptonville and were described by A. W. Jackson (3) p. 371.

VOELCKERITE

See apatite

VOLBORTHITE

Hydrous copper, barium, and calcium vanadate, $6(Cu,Ba,Ca)O \cdot V_2O_5 \cdot 15H_2O$

Monoclinic? Small plates in globular aggregations. Pearly to vitreous luster. Color olive green, citron yellow. Streak yellowish green. H. = 3. G. = 3.5.

A small amount of metallic copper can be obtained by reduction on charcoal, using sodium-carbonate flux. Ammonia added to a nitric-acid solution will show the blue color of copper. Dilute sulphuric-acid added to solution will precipitate barium sulphate. The green bead of vanadium can be obtained with phosphorous salt. Water is given off in a closed tube.

Glenn County: **1**, Volborthite was reported to have been found at the Mammoth copper mine on Grindstone Creek (T. 22 N., R. 9 W., M. D.), S. M. B. (15139), Larsen (11) p. 154.

VOLTAITE

$3(K_2Fe)O \cdot 2(Al,Fe)_2O_3 \cdot 6SO_3 \cdot 9H_2O$

Isometric. In cubic, octahedral, and dodecahedral crystals. Luster resinous. Color dull oil green to brown or black. Streak grayish green. H. = 3-4. G. = 2.8.

Soluble in water.

Napa County: **1**, Black isometric crystals of voltaite were found with knoxvillite and redingtonite at the Redington mine, Melville and Lindgren (1) p. 23.

San Benito County: **1**, Voltaite has been reported from the No. 4 level of the New Idria mine, W. W. Bradley (p. c., '44) S. M. B. (21166).

San Bernardino County: **1**, Voltaite was found by Foshag (19) p. 352 with krausite, copiapite, coquimbite, and other sulphates in a lenticular mass near Borate, about 6 miles northeast of Yermo.

Shasta County: **1**, A. L. Day and Allen (1) p. 118, C. A. Anderson (1) p. 290, observed voltaite with melanterite on some altered pyrite from the Mount Lassen area.

Sonoma County: **1**, Dark-green voltaite occurs sparingly at The Geysers, A. L. Day and Allen (2) p. 40, and **2**, as black crusts in Geyser Creek Canyon, near the Witches Cauldron, Vonsen (6) p. 291.

* VONSENITE—Paigeite, 1920

Iron and magnesium borate, $3(Fe,Mg)O \cdot B_2O_3FeO \cdot Fe_2O_3$

Orthorhombic. Imperfect crystals and granular masses. Very brittle. Brilliant metallic luster. Color black. Streak brownish black. Perfectly opaque and non-magnetic. H. = 5. G. = 4.21.

Fuses easily to a black magnetic mass and gives green flame of boron. Soluble in hydrochloric and sulphuric acids, but unattacked by nitric acid.

Riverside County: **1**, Vonsenite was discovered by M. Vonsen in the old city quarry at Riverside and described and named by Eakle (18) p. 141. The analysis gave:

FeO	MgO	B_2O_3	Fe_2O_3
39.75	10.71	14.12	34.82 = 99.40%

Schaller (p. c., '46) considers this to be paigeite, since the mineral carries some tin which was missed in the first analysis.

WAD

See psilomelane

WARDITE

Hydrous basic sodium calcium aluminum phosphate, $Na_4CaAl_{12}(PO_4)_8(OH)_{18} \cdot 6H_2O$

Tetragonal. Crystals pyramidal, usually striated horizontally. Also as granular aggregates and crusts, as subparallel aggregates of coarse fibers and as radially fibrous and concentrically banded spherulites. Cleavage basal pinacoidal, perfect. H. = 5. G. = 2.87. Color blue-green to pale green, to colorless. Luster vitreous. Transparent.

Fusibility 3 with intumescence to a blebby glass. Difficultly but completely soluble in acids.

San Diego County: **1**, Wardite occurs with jezekite in narrow veins in massive amblygonite in the Stewart mine, Pala, Murdoch (p.c. '53).

WATER—ICE

H_2O

Hexagonal; crystals usually 6-rayed stars (snow crystals). Massive, H. = 1.5. G. = 0.916. Colorless.

Modoc and Siskiyou Counties: **1**, Permanent ice is found in lava tunnels in the Lava Bed National Monument, Swartzlow (1) p. 440.

WERNERITE

See scapolite

WHITE ARSENIC

See arsenolite

* WILKEITE, 1914

$3Ca_3(PO_4)_2 \cdot CaCO_3 + 3Ca_3[(SiO_4)(SO_4)] \cdot CaO$

Hexagonal. Small prismatic crystals and grains. Vitreous. Yellow, pale rose red. H. = 5. G. = 3.234.

Infusible. Soluble in nitric acid.

This rare mineral is unlike any other in having four acid radicals. It resembles apatite in physical properties.

Riverside County: **1**, Wilkeite, discovered at Crestmore, occurs in blue calcite associated with diopside, idocrase, garnet, and its alteration product, crestmoreite, and was analyzed and named by Eakle and Rogers (13) p. 263, A. F. Rogers (31) p. 465.

CaO	MnO	P_2O_5	SO_3	SiO_2	CO_2	H_2O
54.44	0.77	20.85	12.28	9.62	2.10	tr. = 100.06%

The crystal forms were described by Eakle (20) p. 343.

WILLEMITE

Zinc orthosilicate, Zn_2SiO_4

Hexagonal-rhombohedral. Crystals usually prismatic. Also massive and granular. Cleavage basal. Brittle. Vitreous luster. Color white, light green, apple green, flesh red. Streak uncolored. H. = 5½. G. = 3.89-4.18.

Fuses to a white enamel. On charcoal a zinc-oxide coating is obtained, yellow while hot and white when cold, which turns yellowish green when heated with cobalt nitrate. Soluble in hydrochloric acid, yielding gelatinous silica.

Inyo County: **1**, Willemite is found with hemimorphite and hydrozincite at the Ygnacio and Cerro Gordo mines, S. M. B. (8587).

WILLIAMSITE

See serpentine

WITHERITE

Barium carbonate, $BaCO_3$

Orthorhombic. Seldom in good crystals. Usually massive, columnar or granular. Cleavage, one distinct. Vitreous luster. Color white, yellowish, grayish. Streak white. H. = 3. G. = 4.27-4.35.

Fusible. Gives alkaline reaction on turmeric paper. Easily soluble with effervescence in hydrochloric acid. On adding sulphuric acid, barium sulphate is precipitated. Gives green flame of barium.

Mariposa County: **1**, Massive witherite occurs with barite in the deposit near El Portal, W. W. Bradley (12) p. 6, (13) p. 173, Fitch (2) p. 461. According to Dolbear (9) p. 611, the barite of this deposit changes to witherite in the deeper levels. **2**, It is also found with barite in the Devils Gulch (secs. 17, 20, T. 4 S., R. 20 E., M. D.) (N. R.). **3**, Witherite, originally described as alstonite, is found with sanbornite and gillespite 1 mile north of Trumbull Peak, near Incline, A. F. Rogers (39) p. 161.

WOLFRAMITE

Iron and manganese tungstate, $(Fe,Mn)WO_4$

Monoclinic. Thick tabular crystals and massive. One perfect cleavage. Brittle. Metallic to submetallic. Dark grayish or brownish black, brownish red. Thin splinters sometimes deep red. Streak dark brown to black. H. = 5-5½. G. = 7-7.5.

Fusible, but rather insoluble. Fused with sodium carbonate, gives blue-green fusion; on dissolving the fused mass in hydrochloric acid and boiling with metallic tin, the solution first becomes deep blue, then brown. The phosphorous salt bead of tungsten in the reducing flame is a fine blue.

The iron-poor variety is called *huebnerite*, the iron-rich *ferberite*.

Alpine County: **1**, Huebnerite is found in the Zaca mine, Loope (Monitor) district, south of Markleeville, Gianella (1) p. 342.

Inyo County: **1,** Boulders of black wolframite have been found at the Monarch tungsten mine (T. 15 S., R. 41 E., M. D.), Ubehebe district, C. A. Waring and Huguenin (2) p. 129, Partridge (1) p. 311. **2,** It has been reported from the Tin Mountains (T. 12 S., R. 41 E., M. D.) Hess (8) p. 724. **3,** Small pseudomorphs of wolframite after scheelite have been found at the Yaney tungsten mine near Bishop, Bateman (p.c. '49).

Kern County: **1,** Wolframite occurs in a pipe in granodiorite near Woody, Kerr (5) p. 421. **2,** Huebnerite (?) occurs in Jawbone Canyon about half a mile from the Granite King mine, Hess (12) p. 988, (13) p. 354, Partridge (1) p. 313. **3,** Wolframite occurs with scheelite at the Blue Point deposits (secs. 10, 11, T. 30 S., R. 31 E., M. D.), ibid. p. 312.

Madera County: **1,** Large crystals and masses of wolframite weighing several pounds occur in a quartz vein in andalusite schist on the I. X. L. claim, about 12 miles north of Raymond, R. P. McLaughlin and Bradley (3) p. 568. Pyrite is an accessory mineral, Hess (4) p. 271, Krauskopf (1), p. 73. **2,** Brownish-black crystals of wolframite associated with large cubes of pyrite occur in a quartz vein in micropegmatitic granite at the head of Iron Creek, Ritter Range, Minaret mining district, Hess (18) p. 938, Erwin (1) p. 73; Krauskopf (1) p. 72. **3,** Wolframite has been found near Buchanan, Hanks (15) p. 140. **4,** Wolframite has been reported with tellurides, from Chiquita Ridge, North Fork district, (sec. 28, T. 6 S., R. 23 E., M. D.), Laizure (2) p. 306.

San Bernardino County: **1,** Wolframite has been found with scheelite and cinnabar, at the Jack claim, near Nipton, in the Clark Mountains, Hess (8) p. 724, (14) p. 47. **2,** It occurs in a quartz vein with chalcopyrite, sphalerite, and galena at the Sagamore mine, New York Mountains, Hess (8) p. 724, Cloudman et al. (1) p. 790. **3,** Wolframite and huebnerite were found in the Confidence mine (sec. 5, T. 11 N., R. 14 E., S. B.), Kelso district, Tucker (4) p. 340. **4,** Small crystals of wolframite occur in quartz stringers in a pegmatite at the Mojave Annex tungsten mine, north slope of the New York Mountains, 2 miles southeast of Brant, ibid. p. 373. **5,** Huebnerite and wolframite occur in sec. 35, T. 14 N., R. 15 E., S. B., Tucker and Sampson (30) p. 584. **6,** Fine crystals of wolframite, with some huebnerite occur in the Signal district 6 miles north of Goffs, Hess (8) p. 724, Cloudman et al. (1) p. 843. **7,** Wolframite came from 15 miles northwest of Victorville, Hess (8) p. 724. **8,** From the Ivanpah Mountains, Hess (6) p. 712. **9,** Huebnerite occurs in quartz veins with sulphide minerals in the Sagamore (New York mine, secs. 33, 34, T. 13 N., R. 16 E., S. B., Wright et al. (5) p. 67.

Tulare County: **1,** Occurs sparingly with molybdenite and scheelite southwest of Tamarack Lake, Sequoia National Park, approx. secs. 35 and 36, T. 15 S., R. 31 E., Tehipite quadrangle. Krauskopf (1), p. 81.

WOLLASTONITE

Calcium silicate, $CaSiO_3$

Triclinic. Crystals commonly tabular, also short prismatic. Generally in fibrous masses also compact. Cleavage, one perfect. Brittle. Vitreous luster. Color white, gray, rose. Streak white. H.= 4½-5. G. = 2.8-2.9.

Fuses easily and quietly to a clear glass. Soluble in hydrochloric acid usually without gelatinizing.

Wollastonite is formed as a metamorphic mineral in limestone near contacts with intrusive rocks.

Alameda County: **1,** Wollastonite has been found in the Berkeley Hills (N. R.).

Amador County: **1,** It was found massive on the Mokelumne River, near Bear Creek, and analyzed by Hillebrand, Turner (12) p. 703.

Del Norte County: **1,** White divergent masses of wollastonite were found near Crescent City, (N. R.).

Fresno County: **1,** Wollastonite has been found about 3 miles southeast of Dunlap, Noren (p. c., '35). **2,** It occurs in contact-metamorphosed limestone of the Twin Lakes area, Chesterman (1) p. 254.

Imperial County: **1,** It was reported to occur with white grossularite near the state highway, a few miles west of El Centro, Melhase (6) p. 23.

Inyo County: **1,** Wollastonite occurs at the Wilshire gold mine, 25 miles southwest of Laws, Turner (35) p. 172. **2,** It occurs as bunches of radiating fibers with diopside in metamorphosed limestone at Round Valley on the north side of Tungsten Hills, 9 miles west of Bishop, Chapman (1) p. 866. **3,** It occurs in the gangue of the cobalt veins at Long Lake (sec. 14, T. 9 S., R. 31 E., M. D.), Tucker and Sampson (25) p. 378. **4,** A very large deposit is said to occur in the Panamint Range northwest of Warm Springs, Vonsen (p. c., '45). **5,** It is abundant at the Christmas Gift mine at Darwin, A. Knopf (4) p. 12, and in large crystals in the contact limestones of that area, Kelley (4) p. 538. **6,** It occurs at the Cardinal Gold property (sec. 19, T. 8 S., R. 31 E., M. D.), Lenhart (1) p. 3.

Kern County: **1,** A deposit of wollastonite occurs near Code siding in the Rademacher district, W. W. Bradley (21) p. 183, Murdoch and Webb (11) p. 553, Tucker (24) p. 19. **2,** It was found outcropping in fibrous aggregates up to 6 inches along the canyon of Clear Creek between the Kern River and Walker Basin, Melhase (8) p. 7. **3,** It is found with scheelite in a contact deposit at the Rand group, Greenhorn Mountains (secs. 19, 20, T. 25 S., R. 32 E., M. D.), Hess and Larsen (17) p. 263.

Lake County: **1,** White drusy wollastonite has come from Dry Creek, near Middletown, S. M. B. (14012). **2,** Specimens of it have come from near Glenbrook, Irelan (4) p. 47.

Marin County: **1,** It occurs as crystals and layers in schist on the shore of Tomales Bay, 1½ miles northwest of Inverness, F. M. Anderson (1) p. 132.

Mono County: **1,** It occurs with boulangerite in contact limestone in Leevining Canyon (sec. 13, T. 1 N., R. 25 E., M. D.), Murdoch (p. c. '45).

Napa County: **1,** White massive wollastonite occurs in Hunting Creek Canyon, near Knoxville, S. M. B. (13229).

Nevada County: **1,** White and pink wollastonite are found as a contact mineral at Grass Valley (N. R.).

Riverside County: **1,** Wollastonite occurs in fibrous, columnar, and fine granular form in the crystalline limestone at Crestmore as one of the contact-metaphoric minerals, Eakle (15) p. 334, Foshag (12) p. 88. Complex crystals were studied by Eakle. The triclinic character of some wollastonite was confirmed on excellent crystals from Crestmore,

Peacock (3) p. 495. **2**, Pink granular wollastonite occurs at a contact of limestone and granodiorite in the new city quarry, Riverside, Eggleston (p. c. '36). **3**, It was found at the scheelite deposit about 9 miles east of Aguanga, Hess and Larsen (17) p. 261. **4**, Wollastonite occurs with scapolite in the iron ores at Eagle Mountain, Hadley (1) p. 4.

San Diego County: **1**, Large masses of pure white divergent-columnar wollastonite occur near Boulevard (N. R.). **2**, At Carrizo Gorge, near Jacumba, E.M.B. (21224), Symons (5) p. 62.

San Francisco County: **1**, A specimen of wollastonite has come from Fort Point, S. M. B. (205).

Santa Barbara County: **1**, Divergent-fibrous masses of wollastonite having a pale-rose color have been found at Santa Ynez, (N. R.).

Sierra County: **1**, Bands of wollastonite and wollastonite-quartz schist occur near Sierra City, on the small north tributary of the South Fork of the North Fork of Yuba River, opposite Milton Creek, S. G. Clark (p. c. '35).

Siskiyou County: **1**, Fine divergent specimens of wollastonite have come from the limestone on the Salmon River, 3 miles above Somes Bar (N. R.).

Tehama County: **1**, Wollastonite occurs in sec. 16, T. 25 N., R. 7 W., M. D., E. S. Dana (5) p. 1097, S. M. B. (9753).

Trinity County: **1**, White fibrous wollastonite occurs near Hyampom (N. R.).

Tulare County: **1**, Specimens of wollastonite have come from the Upper Tule River, (N. R.). **2**, Massive wollastonite is found in metamorphosed limestone near Three Rivers in sec. 16, T. 16 S., R. 28 E., M. D.; in sec. 25, T. 17 S., R. 28 E., M. D.; and near Lemon Cove, in secs. 11, 14, T. 16 S., R. 27 E., M. D., Durrell (p.c. '35).

* WOODHOUSEITE, 1937

Hydrous sulphate-phosphate of aluminum and calcium, $2CaO \cdot 3Al_2O_3 \cdot P_2O_5 \cdot 2SO_3 \cdot 6H_2O$

Hexagonal-rhombohedral. Rhombohedral crystals. Basal cleavage. Vitreous to pearly luster. Colorless or flesh colored; transparent or translucent. H. = 4½. G. = 3.012.

Readily soluble in dilute acid. Yields water when heated in closed tube.

Mono County: **1**, Woodhouseite occurs in veins with quartz, topaz, lazulite, and augelite in the andalusite deposit at the mine of Champion Sillimanite, Incorporated, on the western slope of the White Mountains, 7 miles east of Mocalno. It was described and named by Lemmon (2) p. 939. An analysis of woodhouseite by A. Rautenberg has been reported by Lemmon (2) p. 943.

P_2O_5	SiO_2	Al_2O_3	CaO	SrO	BaO	MgO	Na_2O
18.13	0.30	36.63	12.31	0.25	1.00	0.11	0.08

K_2O	SO_3	H_2O-	H_2O+
0.02	17.59	0.20	13.25 = 99.87%

WOOD OPAL

See opal

WULFENITE

Lead molybdate, $PbMoO_4$

Tetragonal. Thin tabular crystals: sometimes pyramidal. Granular massive. Cleavage, pyramidal perfect. Brittle. Resinous or adamantine

luster. Orange yellow, bright red, greenish, grayish white to nearly colorless. Streak white. H. = 2½-3. G. = 6.7-7.

Easily fusible. Reduced on charcoal, using sodium carbonate as flux, it yields metallic lead and a yellow coating. Powder dissolved in a few drops of strong sulphuric acid by boiling, gives a solution which turns blue when a small amount of organic matter is introduced, a piece of paper the size of pinhead generally being sufficient; the blue solution turns brown in a short time.

El Dorado County: **1,** Wulfenite occurs in small grains near Garden Valley (N. R.).

Imperial County: **1,** Fine crystals of wulfenite have been found north of Salton, Orcutt (4) p. 26.

Inyo County: **1,** Crystals of wulfenite occurred with the linarite and caledonite of the Cerro Gordo mine, R. W. Raymond (1) p. 29. **2,** It has been observed in the Darwin mines, Murdoch and Webb (14) p. 325. **3,** It has been reported from the Ophir and other mines in the Slate Range, Tucker (11) p. 510. **4,** Wulfenite occurs as thin seams and crusts on malachite at the Empire mine (T. 21 S., R. 45 E., M. D.), W. P. Blake (14) p. 125. **5,** Well-formed crystals have been found at the Brown Monster mine, 2 miles east of Manzanar station, G. M. Wheeler (1) p. 45, A. Knopf (5) p. 118.

Kern County: **1,** Wulfenite was found 6 miles northeast of Kane Springs, Hanks (12) p. 395. **2,** It has been tentatively identified in the gold ores of the Yellow Aster mine, Hess (10) p. 35.

Mono County: **1,** Crystals of wulfenite have been noted on a specimen of pyromorphite from Blind Spring Hill, A. L. Ransome (2) p. 192. **2,** Crystals of wulfenite have been found in an oxidized lead vein 6 miles east of Hammil station, Woodhouse (p. c., '45).

Plumas County: **1,** It was found at the Diadem lode on Mumford Hill (N. R.). **2,** Wulfenite occurs in an oxidized zone in the Granite Basin district, Turner (12) p. 589.

Riverside County: **1,** It occurs at the El Dorado mine near Indio, Webb (p. c., '45). **2,** It was reported to occur in the gold mines of the Chuckawalla Mountains, Orcutt (2) p. 901.

San Bernardino County: **1,** Wulfenite was found with cerussite in the Silver Reef district. **2,** At Holbergs gold mine in the Lava Beds district, Storms (4) pp. 366, 359. **3,** Crystals of wulfenite from Lavic were described by Guild and Wartman (2) p. 167. **4,** It occurs with vanadinite at the Vanadium King mine, near Goffs, University of California Collection, Berkeley. **5,** It was observed in limestone in the upper part of Black Hawk Canyon, Woodford and Harriss (4) p. 268. **6,** It is found in the Calico district, Cloudman et al. (1) p. 829. **7,** A considerable mass of wulfenite was shipped from near Tipton, Mining and Scientific Press, (32) p. 171. **8,** Wulfenite is a minor constituent of the bastnaesite deposit at Mountain Pass, Pray (p.c. '51).

San Luis Obispo County: **1,** It was found at the Fairview mine (N. R.).

WURTZITE

Sulphide of zinc, ZnS

Hexagonal. Crystals hemimorphic pyramidal. Often fibrous or columnar; as concentrically banded crusts. One prismatic cleavage fair. H. = 3½-4. G. = 3.98. Luster resinous. Color brownish black. Streak brown. Same reactions as sphalerite.

Mono County: **1**, Found in small orange-brown grains in contact limestone, with boulangerite and wollastonite (S½ sec. 13, T. 1 N, R. 25 E., M. D.), Milton (p. c., '44).

XANTHOCHROITE

See greenockite

XANTHOPHYLLITE

Hydrous magnesium, calcium, and aluminum silicate, $H_8(Mg,Ca)_{14}Al_{16}Si_5O_{52}$

Monoclinic. Crystals tabular parallel to the base. Perfect basal cleavage. Plates are not flexible. Vitreous luster. Color leek green or bottle green. H. = 4-5. G. = 3.08.

Riverside County: **1**, Abundant platy crystals of xanthophyllite occur in the blue calcite at Crestmore, intimately associated with monticellite, and scattered through the inner contact zone, Eakle (14) p. 333. Woodford et al. (10) p. 375. **2**, Xanthophyllite occurs in minor amounts in a contact zone 1½ miles northeast of Winchester, Larsen (17) p. 36.

XENOTIME

Yttrium phosphate, YPO_4

Tetragonal. In crystals resembling zircon, but frequently nearly flat double pyramids. Perfect prismatic cleavage. Brittle. Luster resinous to vitreous. Color and streak yellowish brown. H. = 4-5. G. = 4.45-4.56.

Infusible. Insoluble in acids.

Riverside County: **1**, Xenotime was found in well-formed crystals in pegmatite at the Southern Pacific silica quarry near Nuevo, Melhase (7) p. 11. It occurs here also in parallel growth with cyrtolite, Murdoch (p. c., '45). **2**, It was reported from a pegmatite 2 miles north of Winchester (sec. 9, T. 5 S., R. 2 W., S. B.), W. W. Bradley (23) p. 117.

XONOTLITE

Hydrous calcium silicate, $Ca_3Si_3O_8(OH)_2$

Orthorhombic? Compact fibrous. One perfect cleavage. Vitreous to silky luster. Color snow white, pink. H. = 6½. G. = 2.7.

Fuses easily to a glassy globule. Easily soluble in hydrochloric acid with the separation of flaky silica. Yields water at a high temperature. Xonotlite closely resembles pectolite in structure.

Mendocino County: **1**, Pale pink xonotlite occurs with pectolite, nephrite, and calcite in sheared serpentine at Leech Lake Mountain, Chesterman (p.c., '55).

Riverside County: **1**, "Jurupaite" from Crestmore has been shown to be identical with xonotlite, H. F. W. Taylor (2) p. 338. Radiating white fibers up to 2 centimeters in length, associated with blue calcite and cinnamon-brown grossularite were described as a new mineral, Eakle (15) p. 347, (20) p. 107, named jurupaite. It is now a discredited species.

San Francisco County: **1**, Xonotlite occurred with brucite in veins in serpentine exposed by excavations of the Western Pacific Railroad on Army Street, San Francisco, Pabst. (p. c., '44).

Santa Barbara County: **1**, A mineral specimen collected years ago near Santa Ynez, labeled wollastonite, was found by Larsen (8) p. 465 to differ optically from that mineral, and on the supposition that it was a new mineral, he proposed the name eakleite for it. Larsen (13) p. 181 later showed this material to be xonotlite.

YTTROCRASITE

Perhaps $(Y,Th,U,Ca)_2(Ti,Fe,W)_4O_{11}$

Orthorhombic? Color black; nearly opaque. H. = 5½-6. G. = 4.8. Luster bright pitchy to resinous.

Riverside County: **1**, A few minute tabular crystals from the pegmatite of the Southern Pacific silica quarry at Nuevo, gave on spectroscopic analysis by Kennard and Drake: Fe,Ti,Y,large; Mn,Si,small. It may be doubtfully referred to this species, Murdoch (p. c., '45).

ZARATITE

Hydrous carbonate of nickel, $NiCO_3 \cdot 2Ni(OH)_2 \cdot 4H_2O$?

Amorphous. In mammillary incrustations; also massive compact. Brittle. Vitreous luster. Color emerald green. Streak green. H. = 3. G. = 2.6.

B.B. infusible. Imparts to the borax bead a brown color which, when reduced, becomes gray and cloudy. Effervesces in hot acid. Gives water in closed tube.

Zaratite is always accompanied by chromite, occurring as an incrustation on massive chromite. Most of the green coatings on the chromite of the state, however, consist of small uvarovite garnet crystals or green chlorite. J. B. Trask (2) p. 57, notes its occurrence in fractures of chromite in the Coast Range Counties from Contra Costa southward.

Alameda County: **1**, Green coatings of zaratite (?) occur on the chromite at the Mendenhall mine on Cedar Mountain, Woodhouse (p.c., '45).

Contra Costa County: **1**, "Nickel green," perhaps zaratite, was observed by J. B. Trask (4) p. 388, in this county.

Madera County: **1**, It was found as a coating on chromite near Madera, S. M. B. (13414).

Mendocino County: **1**, Hanks (15) p. 140, reports zaratite on boulders of chromite in T. 20 N., R. 14 W., M. D.

Monterey County: **1**, It was found on the chromite in this county, W. P. Blake (3) p. 82, (7) p. 303, (9) p. 13, Hanks (12) p. 396.

San Benito County: **1**, Zaratite was found on chromite near Hollister and near Panoche, Hanks (12) p. 396.

San Luis Obispo: **1**, Zaratite has been reported near San Luis Obispo, Cronise (1) p. 593.

Shasta County: **1**, It was observed on the chromite at Castella (N. R.).

Siskiyou County: **1**, Green coatings of zaratite occur on the chromite near Callahan (N. R.).

ZINC

Zn

Hexagonal. One perfect cleavage. Rather brittle. Color and streak white, slightly grayish. H. = 2. G.= 6.9-7.2.

No undoubted occurrences of native zinc are known.

Shasta County: **1**, Several pieces of metallic zinc were reported by Fairbanks (2) p. 30, as coming from 5 miles southwest of Round Mountain. He is dubious of their truly natural character, but says that a fragment of rock was attached to one piece, and therefore considers that they may be authentic.

ZINCBLENDE

See sphalerite

ZINNWALDITE

An iron lithia mica near biotite in composition and appearance

Color pale violet, yellow to brown and gray. Occurs in pegmatites and hydrothermal veins.

San Diego County: **1**, Zinnwaldite in dark gray to reddish brown flakes and crystals, up to a quarter of an inch in size is associated with beryl, cleavelandite, etc. in pockets of the pegmatites at Pala, Jahns and Wright (5) p. 31.

ZIRCON

Zirconium silicate, $ZrSiO_4$

Tetragonal. In small prisms. Brittle. Adamantine luster. Colorless, yellowish, grayish, brown, pink. Streak uncolored. H. = 7½. G. = 4.68-4.70.

Infusible. Fused with sodium carbonate, the hydrochloric acid solution turns turmeric paper an orange red.

Zircon is a very common minor constituent in the acid intrusive rocks, especially granites and syenites. Accordingly, the sands derived from the weathering of these rocks contain grains of zircon, and they are sometimes quite abundant in the black sands and gold placers from such sources. It is seldom a conspicuous mineral, but occurs in small grains in many of the sands of the state.

Alameda County: **1**, Zircon was mentioned by Palache (3) p. 184 as one of the constituents of the soda rhyolite of North Berkeley.

Butte County: **1**, Zircon was first mentioned in this state by Silliman (13) p. 385 as a constituent of the gold washings at Cherokee.

Fresno County: **1**, Splendid crystals of zircon have been found in the sands at Picayune Flat, Hanks (15) p. 141.

Los Angeles County: **1**, Abundant clear pinkish crystals of zircon have been found in a pegmatite in Pacoima Canyon (sec. 17, T. 3 N., R. 13 W., S. B.), Neuerburg (2) p. 833.

Mono County: **1**, Minor amounts of zircon have been observed in the great andalusite deposit 7 miles east of Mocalno, R. J. Sampson and Tucker (4) p. 461, Woodhouse (4) p. 4.

Nevada County: **1**, Zircon is an abundant accessory mineral in the granodiorite of Nevada City, Lindgren (12) p. 37. Black sands from this area have yielded 928 pounds of zircon per ton, ibid. (20) p. 74.

Placer County: **1**, Hyacinthine zircon is mentioned by Genth (1) p. 113, in sands with platinum and iridosmine on the North Fork, American River. **2**, It has been produced commercially from the sands near Lincoln, Woodhouse (p.c., '45).

Plumas County: **1**, Zircon was a principal constituent of heavy sands from placer diggings at Spanish Ranch (Eagle Gulch), Turner (19) p. 426.

Riverside County: **1**, Zircon crystals of moderate size occur in some of the pegmatites at Crestmore, Eakle (15) p. 349, Woodford et al. (10) p. 375.

San Bernardino County: **1**, Cyrtolite occurs with betafite in a lens of platy biotite in a pegmatite in the Cady Mountains, north of Hector, Hewett & Glass (3) p. 1044.

San Diego County: **1,** Zircon occurs in the pegmatite near Ramona, J. W. Patton (1) p. 116.

References to a few of the other minor occurrences follow listed by county: Amador: S. M. B. (4892); Mendocino, Hanks (15) p. 141; Plumas, Graton and McLaughlin (4) p. 6; Riverside, Harder (6) p. 45; San Diego, Schaller (7) p. 211; Siskiyou, Eakle (1) p. 319. Zircon is found in addition, in minor amounts, in sands of the following counties: Calaveras, Del Norte, El Dorado, Humboldt, Marin, Nevada, Sacramento, San Luis Obispo, San Mateo, Santa Barbara, Santa Cruz, Shasta, Trinity, and Yuba.

ZOISITE

Basic calcium and aluminium silicate, $Ca_2Al_3(SiO_4)_3(OH)$

Orthorhombic. Prismatic crystals. Massive; columnar to compact. One perfect cleavage. Brittle. Vitreous luster. Color grayish white, greenish gray, rose red. Streak uncolored. H. = 6-6½. G. = 3.25-3.37.

Fuses rather easily with some intumescence to a light-colored slaggy mass, which, if pulverized and boiled in hydrochloric acid, will yield gelatinous silica. A small amount of moisture can be obtained in a closed tube by intense heating. ***Thulite*** is a pink variety containing a small amount of manganese. ***Saussurite*** is a mixture of zoisite, calcite, and plagioclase feldspar formed in gabbros and plutonic rocks by alteration.

Zoisite is often developed by the metamorphism of gabbros and diorites.

Inyo County: **1,** Thulite occurs in large irregular patches in boulders on the east side of Saline Valley near the south end, Murdoch and Webb (11) p. 69 (called bustamite by them), Schaller and Glass (54) p. 519.

Kern County: **1,** Zoisite crystals up to 1 inch in length occur in schist about 2 miles south of Randsburg, Hulin (1) p. 25.

Lake County: **1,** The zoisite mentioned by Becker (4) p. 79 as common in the metamorphic rocks at Sulphur Bank is probably pale epidote. It is common in the Coast Range, ibid. p. 79.

Los Angeles County: **1,** White veinlets of fine-grained zoisite occur cutting albitized rock in many places in the Santa Monica Mountains, localities 27, 28, 29, 30, 31, 32, Neuerburg (1) p. 160.

Mendocino County: **1,** Very large radiating crystal clusters of zoisite have been found at Syke Rock (T. 20 N., R. 14 W., M. D.), 3 miles east of Longvale on the new Covelo road, Vonsen (p.c., '45).

Mono County: **1,** Zoisite, variety thulite, has been found near Baldwin Mountain, associated with scheelite in a contact zone, Kerr (6), p. 159).

Plumas County: **1,** It was reportedly found with rhodonite in the Diadem lode, Meadow Valley, Turner (12) p. 590.

Riverside County: **1,** Thulite is found in bright-pink crystals in quartz monzonite pegmatite at Crestmore, Woodford et al. (10) p. 214.

San Bernardino County: **1,** Zoisite occurs with axinite in the Henshaw quarry, SE ¼ sec. 33, T. 1 S., R. 5 W., S. B., Cooney (p.c. '53).

San Diego County: **1,** Zoisite occurs with actinolite in boulders of sausserite gabbro in the San Onofre breccia, Woodford (2) p. 193.

Santa Clara County: **1,** It was mentioned by Murgoci (1) p. 359, and J. P. Smith (1) p. 193, as a microscopic constituent in the eclogite of Oak Ridge.

Sonoma County: **1**, Zoisite occurs near Healdsburg (N. R.).

Tulare County: **1**, Large masses of zoisite occur in a metamorphosed gabbro west and south of Rocky Hill, near Exeter (secs. 18, 20, T. 19 S., R. 27 E., M. D.), Durrell (p.c., '35).

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